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CONTENTS

The Conservation of Fish Stocks 1

General Trends:

Radioactive Fish Tag 6
Skipjack in Captivity 6
Fish Breeding 7
Tilapia and Nile Perch 7
Hybrid *Tilapia* 8
Reducing Water Evaporation 9
Controlling Water Evaporation 9
Fish Factories 10
Radiation Processing Research 10
Radiation Preservation of Cod 11
Freshness of Tuna 12
Edible Protein 12

— *Contents continued overleaf* —

INDO-PACIFIC FISHERIES COUNCIL
FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS
BANGKOK THAILAND

News from the Region:

Australia 13
Burma 14
Cambodia 14
Ceylon 14
India 15
Indonesia 17
Japan 18
Korea 20
Federation of Malaya 21
Pakistan 25
Philippines 27
South Pacific Commission 28
Singapore 29
Taiwan 31
Thailand 32
North Borneo 33
Hong Kong 33
U.S.A. 36
Vietnam 37

FAO Activities:

Appointments 40
Technical Assistance 40
Fellowships 40
Documents 41

IPFC Affairs:

Personnel 42
9th Session 42
Circulars 42
Fish Processing Training Center 43

Personalia 43

Current Reading 43

Meetings and Conferences 45

Forthcoming Meetings and Training Centers 48

THE CONSERVATION OF FISH STOCKS

by

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Covering as they do seven-tenths of the earth's surface, the seas and oceans of the world have been, and seem likely always to be, an important source of supply of man's food. Though now, and for the foreseeable future, fishing may be likened to hunting, rather than to agriculture and, at least in the open sea, nothing can be done directly to improve the stock of fish, the future of a fishery can be greatly affected by the quantity and quality of the catch removed from the stock. Conservation of fish stocks is therefore concerned with suitable regulation of fishing (how much and what sort of fish to catch), and the main problems are firstly establishing the facts as to how fishing controls the level of the stocks and hence future catches, and secondly deciding in the light of these facts how the fishery should be regulated to the best interests of all concerned in it, producer and consumer, present and future.

The influence that intensive fishing could have on fish stocks first became apparent at the end of last century when the rapid expansion of steam trawling in the North Sea was followed by an almost equally rapid decline in the abundance of the most valuable species, particularly plaice. Confirmation of the connexion between fishing and stock was given when the reduction of fishing in the 1914-18 war resulted in a great increase in stock, followed by a corresponding decrease after 1919. The same sequence of events occurred in 1939-45, the plaice in 1945 being about ten times as abundant as in 1918. During the interwar period the general understanding and theory of the overfishing problem was slowly developed, and since the war a satisfactory quantitative theory of fish populations has been produced (see Beverton & Holt, 1957). Essentially the theory depends on following a brood of fishes from the time the fish become vulnerable to fishing, until they are all dead. Their numbers at any time will depend on the initial numbers—the recruits—and the mortality rate since. The latter is conveniently split between that due to fishing, and that due to other or 'natural' causes. The number caught in any short time interval will be proportional to the product of the number alive during that time and the fishing rate. The total number caught can then be obtained as the integral over the life span of the fish. The catch in weight is obtained similarly, by introducing a suitable mathematical expression for the growth of the fish, giving its weight at any time, so that the weight caught is the integral over the life span of the number caught in each interval of time multiplied by the average weight of the individual fish at that time. Fortunately there is a growth equation, that of von Bertalanffy (1938) which both fits the observed weight at age of most fish and gives an expression that can be integrated quite easily. Other important characteristics of the stock, e.g. its abundance in numbers or weight, the average size of fish in the catch, may be calculated fairly readily.

(Symposium of The Nutrition Society on Fish, 28 and 29 March 1958, Proceedings of The Nutrition Society, 1958, Vol. 17, no. 2, p. 132).

(Reprinted from Proc. Nutr. Soc., 1958, 17, 132).

Of the factors which influence the yield two are directly under human control: the fishing mortality, which is directly proportional to the fishing effort—the amount of fishing carried out—and the age or size at which the fish are first liable to capture. The latter, though not completely controllable may be varied over quite wide limits, e.g. by the use of large-meshed nets which allow the small fish to pass through. The other important factors such as recruitment and growth cannot be affected directly, unless we look forward to the distant future of extensive fish rearing or fertilization of the sea. There are indirect effects, in that it would be expected that an increased stock (due to successful regulation) would give a greater number of young fish, but the greater crowding would slow down that growth and increase the mortality due to disease and parasites. In fact there are few, if any, well-established instances of the size of the spawning stock of marine fish influencing the resultant number of young fish—which is perhaps not surprising if we remember the vast number of eggs, running sometimes into millions, which a single female fish can produce. Again, influence of stock size on growth has rarely been strongly marked, even for some of the North Sea stocks which increased by a factor of about ten between 1938 and 1945.

As, therefore, the effects of density-dependent recruitment, growth and mortality are ill-defined, and the first acts in opposite manner to the other two, they have often, quite reasonably in the lack of better data, been assumed to be negligible and the recruitment, growth and natural mortality assumed to be constant. If this assumption is made then the effect of changes in the amount of fishing, or in the age at first capture, can be readily evaluated, given the necessary data on the present values of the relevant factors.

Without going through the mathematics, we may now examine these effects, as calculated by the relevant equations, considering first changes in the amount of fishing. As fishing is increased the number of fish caught will also increase, and will continue to increase with increased amount of fishing, but tending to an asymptotic level, at which all the fish are caught as soon as they become vulnerable to the fishing gear used. However, as the amount of fishing increases, the increased mortality will decrease the average expectation of life of each fish and hence the average age and size of fish in the catch. The total weight of the catch will at first increase with increasing fishing almost as fast as the numbers in the catch, but more slowly as the size of the individual fish falls off; not infrequently the weight caught reaches a maximum at a certain level of fishing and thereafter decreases. A hypothetical example (differing not to much from that of the North Sea plaice) of how this may come about is of a fish which becomes vulnerable to fishing at a weight of $\frac{1}{4}$ lb., but could grow up to 15-20 lb; with no fishing the average weight of a fish is 2-3 lb. At a low level of fishing, out of every hundred fish reaching a catchable size ten are caught at an average of 2 lb., 20 lb. in all; at an intermediate level fifty fish (average 1 lb., total 50 lb.), whereas at a very high amount of fishing ninety fish are caught, but each weighs on the average $\frac{1}{3}$ lb. and the weight caught is only 30 lb. It may be seen that the conditions for the existence of such a maximum in the 'yield curve' (the plot of weight caught against amount of fishing) are in general terms a growth pattern such that a fish can reach several times the weight

at which it is first vulnerable to the fishery, and a low rate of natural mortality so that, with little fishing, it has a good chance of reaching a large size. These conditions are in fact fulfilled by many of the important fish stocks, e.g. cod, plaice and haddock. The presence of a maximum in the yield curve has been known for a long time for several stocks, and it has often been considered that the objective of conservation measures should be to hold the fishing effort at the level giving this maximum catch.

Besides alterations in the total amount of fishing, the effect of the fishing on the stock, and hence the catch, can also be altered by changes in the size at which fish are first liable to be caught, e.g. a change in the size of the meshes in the net. As it is increased the average size of the fish in the catch increases, but the number caught decreases, as more and more fish die before reaching the catchable size. Taken together the two effects give a maximum catch at some intermediate size. This size will be determined by the chances of catching the fish, given by the relative magnitudes of the death rate due to fishing alone and to all causes, and by the amount the fish is likely to grow. The optimum size of first capture is therefore determined inter alia by the amount of fishing; with heavy fishing it pays to wait and let the fish grow. More interesting, and in contrast to the earlier result, the catch obtained by using the best size of first capture for a given amount of fishing increases continuously with the amount of fishing, never reaching a maximum. In theory then, allowing variation in both amount of fishing and size of first capture, the greatest catch would be obtained with a relatively large size at first capture and a virtually infinite amount of fishing, i.e by waiting till the fish reach the best size and then catching them all at once–which is indeed effectively a technique often used in the limited areas of fish ponds, but impractically costly in the open sea.

These results, giving the catch in weight, for a single species, may quite easily be extended in several ways. For instance, the size composition of the fish in the catch is calculable and, given the present relation between the size of fish and value, there is no difficulty in handling the biological data necessary to predict the value of the catch at any future level of fishing, though economic effects might alter the picture. Because conservation measures usually increase the average size of fish in the catch, and pound for pound large and medium-sized fish fetch better prices than small fish–in part because they have a slightly higher proportion of edible flesh–gains due to conservation measures calculated, as they usually are, in terms of weight will underestimate the gain in value.

Though sometimes fishing in a region may be effectively confined to one species, in temperate waters there may be half a dozen or more commercially important species, and perhaps a hundred or more in the tropics. If two species are caught by quite different fishing gears, e.g. herring and plaice in the North Sea, then they can be treated independently giving two independent optimum amounts of fishing and size of first capture. More often the same gear will catch several species, e.g. a North Sea trawler will catch cod, haddock and plaice. Then the mesh size in use will define the size of first capture for each species, and this with the known amount of fishing will enable the catch of each species to be calculated and by simple addition, the

total catch, in weight or value, is obtained. As before, the optimum mesh size for a given amount of fishing, or the amount of fishing giving the maximum catch with fixed mesh size, is readily determined, but these may well be different from the best, for most, if not all, species taken separately. In particular, when as in the North Sea the relatively big fish (cod and plaice) are the most important, the best mesh sizes at high rates of fishing will be so big that nearly all the small fish (e.g. whiting and sole) will get through.

The biological data needed for a conservation policy have now been outlined, though extremely sketchily; it remains to conclude by outlining even more briefly some of the objectives, methods and difficulties in practical fisheries conservation. As has been mentioned, there is no danger of any marine fish becoming extinct as a result of too much fishing; also the greatest possible catch in general would be obtained by using a very large mesh and a very great and impractical amount of fishing. It is therefore difficult to give an objective for conservation definable purely on biological grounds. Re-examination of the earlier results in economic terms enables the value of the catch to be determined, and the cost of catching it will be closely proportional to the amount of fishing, and independent of the size of first capture. Because it is independent of the cost, the first capture should, whatever the amount of fishing, be adjusted to give the maximum yield at that fishing rate. For a given economic situation then, the net yield of the fishery can be calculated; with increasing fishing the net yield increases from zero up to a maximum and then decreases to zero, and below at high fishing rates. This maximum does then provide a definable objective for conservation, but the position and value of the maximum will change with economic changes, or changes in the efficiency in the gear.

Many of the difficulties in applying conservation measures are the same as those causing the original state of overfishing. Stocks of marine fish belong to no one and therefore all too often no one is immediately interested in conserving them. If any one section of a fishery does apply conservation measures, e.g. one country restricts its amount of fishing, or a trawler increases its mesh size, then the fishery as a whole benefits, but those applying the measures will lose, unless they form the major part of the fishery. Therefore conservation measures have to be applied to the whole of a fishery. Its application is relatively simple when conditions throughout a fishery are relatively uniform, with say only one species of fish caught by the same gear for the same purpose; such fisheries provide several notable examples of successful conservation. In the North Sea the situation is more complex, with a wide range of fish species, gears and markets, and there are many problems to be solved, not only on the effect of conservation measures on these various fisheries, but, and more difficult, how to compensate in some form those sections that would lose during the general gain from a conservation measure. For instance in the North Sea a mesh size much greater than the present 75 mm would increase the general yield, but cer-

tain minor fisheries based mainly on small fish like sole and whiting would gain little or even lose, which has made it impossible so far to achieve an increase in mesh sizes.

Regulation of the size of meshes is not the only measure used to protect small fish; areas known to contain predominantly small fish can be closed, or the landing of fish below a certain size can be prohibited. The amount of fishing can also be controlled by a range of measures, such as catch quotas, close seasons, limitation in size or type of ship or gear, or in the number of ships engaged. Some of these measures, however, tend to reduce the efficiency of the fishery, and as much of the fruits of conservation lie not in greatly increasing the catch but in catching it at less cost, these conservation measures defeat themselves. In fact the problem of how best to benefit fully from the potential benefits of conservation, which can be easily shown to exist, has not yet been solved. The potential gains are great; in the North Sea alone the British catch of bottom-living fish is worth some £12 million a year; the cost of catching it must also be around £12 million, but under the best conservation the catch could be increased by at least 25%, to £15 million, and the cost of catching it reduced by a third, say to £8 million. The prize of £7 million each year therefore waits suitable international agreement on conservation, and it is to be hoped that it will not be too long delayed.

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SHARKS JUST GOT NEEDLED

A skin-diving team fired tranquilising drugs into sharks off Cronulla, (Australia) in an attempt to stun them. Instead, the drugs stimulated the sharks.

A team member said: "It was a disappointing experiment. The drugs we used actually speeded up the sharks."

The shark-hunters are experimenting with a variety of drugs in the hope of finding one which will reduce the menace of sharks to underwater fishermen and professional divers. A doctor accompanied them.

GENERAL TRENDS

Radioactive Fish Tag

On February 16, 1960, the U.S. Atomic Energy Commission issued a license to the Bureau of Commercial Fisheries for the use of a new low-level radioactive fish tag to be used in Southeastern Alaska herring migration studies, The new tag, like the old type, is inserted in the body cavity of the herring, but being radioactive, is much more speedily and accurately recovered by special detectors at the processing plant. Thousands of herring will eventually be tagged, released, and then caught again at a later date by fishermen who deliver them to the processing plant. Fish tagged with the radioactive "belly insert tag" are immediately detected at the plant, recovered, measured, and aged. In this way the strength of year-classes or populations, and the migrations of these fishes may be determined for management purposes. It is not known at present when the tagging program will get underway. It is unlikely that the public would ever come into contact with the new tag because of many precautionary measures. Even so, the tags are of such low-level radioactivity that no hazard exists. (*Comm. Fish. Rev.*, April 1960).

Skipjack Held In Captivity Successfully

Oceanic skipjack tuna (*Katsuwonus pelamis*) were successfully introduced during February 1960 into a pool at the Honolulu (Kewalo-Basin) Biological Laboratory, of the U.S. Bureau of Commercial Fisheries. and are feeding in captivity. This is the first time that oceanic skipjack have been so held for more than a few hours or have been induced to feed. The major portion of this success is attributed to the elimination of manual handling of the fish. Transportation of the fish from the ocean to the pool was accomplished in such a way that the skipjack were only out of water momentarily and were touched only by a barblesshook. A portable steel, oval tank, 2.4 by 1.8 meters and approximately 0.60 m. deep, was secured to the deck of a chartered commercial live-bait vessel. When the skipjack were hooked, the fisherman lowered the fish into the tank with enough slack in the line to allow the fish to shake off the hook. During transport, water was continually circulated within the tank. When the vessel reached shore, the tank was lifted from the ship and immersed in the pool. A hatch in the side of the tank was opened and the skipjack were allowed to swim out of the tank into the pool. The pool is circular, 7 m. in diameter and 1.2 m. deep. Pumps are arranged so that sea water from an adjacent channel or saline water from a well can be pumped into the pool. As water from the well is devoid of oxygen, it is allowed to cascade down a special aerator before flowing into the pool.

The only food that has been fed to the skipjack thus far has been chunks of shrimp, which have been purchased frozen from commercial sources. With this significant advance in the Bureau's skipjack tuna behavior studies, plans are being made for the construction of more suitable tanks and associated instrumentation in which skipjack behavior may be observed. It is planned that conditioned response studies will be undertaken. These studies will involve variables

which cannot readily be controlled at sea such as sound, light, and various extracts including fish blood, visceral extracts, etc., and will supplement those made at sea from the underwater observation chambers on the Bureau's research vessel *Charles H. Gilbert.* (*Comm. Fish. Rev.* May 1960).

Fish Breeding

A new variety of fish has been developed by cross breeding ocean salmon and fresh water trout, the new breed was produced by a group of scientists in the Hokkaido Fishery Incubation Station. The creation of the new breed is significant in two ways. First of all, the newly developed fish promises to be a big, delicious species which will taste just as good if not even better, than the ocean salmon, the Japanese are so fond of. But more important, it can be spawned and raised in fresh water. Salmon migrate during the spawning season to fresh water streams in the Soviet Union, the United States, Canada and Japan. When the young fish are hatched, they descend the streams and swim toward the sea. Since they were spawned in the rivers of various countries, it is hard to determine the various countries' respective fishing rights. The Japanese people know how much trouble this can cause. A partial solution to the question may be the new fresh water fish that was developed recently.

The new variety was developed by cross breeding male ocean salmon with a fresh water trout popularly known as the sockeye or blueblack trout. Scientists at the incubation station obtained 3,500 fish eggs from the fresh water trout and put them into an experimental tank. Ocean trout were then released in the tank to fertilize the eggs. When the incubation period was over and young fish began to emerge, the scientists found that 50 per cent of the eggs had been successfully incubated. The cross breeding proved to be a success and the newly hatched fish can live in fresh water. When fully developed, the fish are expected to grow larger than trout, which normally attain a length of about 38 cm. A great number of sockeye trout is now being raised in the fresh water takes that abound in Japan. Trout will eventually be used to provide the eggs for the development of the new salmon-trout breed of fish. The development of a new variety of fish which can thrive in fresh water may be called a sort of ichthyological breakthrough. By developing the new breed of fish, a way have been opened toward the hatching of salmon-type fish in landlocked waters. (Japanese Information Office, Bangkok, 1 July 1960).

Tilapia and Nile Perch

Mixed cultivation of *Tilapia*, carp and Nile perch in fish ponds in Uganda has the promise of quadrupling fish production from ponds in that country in as many years. The experimental work which undertaken by an FAO expert during the past year at the Kajansi fish farm, Uganda, showed that the 5,000 ponds in Uganda could support more and other varieties of fish than their current occupants-*Tilapia*. Uganda now produces roughly 500 metric tons of fish from her ponds each year. With a mixed fish population, improved management, the right gear and fertilization, the yield from the ponds might reach 2,000 tons yearly in four or five years. Since fish, a relatively cheap source of animal protein, could not be brought to the people, the government decided to bring people to the fish, by means of ponds. *Tilapia*, a small, rapidly

multiplying and hardy fish was selected, the ponds were built and then stocked with three varieties of *Tilapia-zillii*, *nilotica* and *leucosticta*. *Tilapia nilotica* and *Tilapia leucosticta* live on the ponds' natural production of small aquatic organisms. On the other hand, *Tilapia zillii* needs to be fed artificially on foods such as elephant grass, sweet potatoes, etc. in addition to the natural resource of the pond.

Tilapia nilotica and *Tilapia leucosticta* now yield only 300 kg. of fish per hectare a year, just using the ponds' natural resources. However, by feeding these fish, the production could be boosted to 2,000 kg. of fish per hectare per year. Under experimental condition is small ponds, the production of fish may be extremely high. For example, a maximum of 3,500 kg. of fish per hectare per year has been produced in one small pond. The average carp attains a weight of 1,500 g. in the first year. The idea of mixing in carp with the *Tilapia* was first broached in Uganda in 1958, when fingerlings were brought to the fish farm from Israel. Some of these carp now weigh 4,500 g. The predatory Nile perch was introduced to the ponds' population of carp and Tilapia to keep down the number of small *Tilapia*. The Nile perch, which is also excellent eating, averages about 50 kg. in lakes when fully grown and has reached a record weight of 175 kg. (in Lake Albert). This gives the ponds a mixed population of the quickly multiplying *Tilapia*, the rapidly growing carp and the Nile perch as a control.

The Culture of Hybrid *Tilapia*

The cross African male *Tilapia mossambica* with Malayan female *Tilapia mossambica* results in a hybrid which is much more vigorous than either of the parent strains and grows twice as fast. In addition, this particular cross procuces a practically all male brood of fry, so that sexing becomes unnecessary. However, a number of precautions are essential for the successful culture of this fish, and the methods adopted at the Research Institute have been evolved from experimental observations to incorporate these precautions.

1. Guaranteed parent stocks: Since the hybrids are interfertile with the parent strains great care must be taken to prevent contamination of the parent strains by back-crossing. After the fry have been produced the parents must be removed and separated into their respective sexes and kept apart. The Research Institute can supply guaranteed pure-stocks.

2. Ensuring that mating and the production of fry shall be successful:

The breeding cycle of *Tilapia mossambica* lasts three months. The parent fish must be fresh and have rested from breeding by being kept apart for at least three months.

3. Ensuring that there is no back-crossing in the fry pond:

Since the fry reach breeding size in three months and can back cross to the female parent it is essential that the parents be removed before that period. Two methods of culture are recommended by the Tropical Fish Culture Research Institute, Malacca depending on which is more suitable in the particular circumstances. In both cases two small ponds, about 40 m^2 acre are needed in which to keep the African male parents and the Malayan female parents separately before mating. The actual mating can take place either (a) in a small 40 m^2 pond or

(b) in a wire netting pen in the main fattening pond, whence the fry can escape through the wire meshes to the main pond area. As soon as the fry are sufficiently big to fend for themselves the parents can be removed. In any case the parents must *never* be allowed to remain more than two months. This period ensures that spawning will take place, but is too short for the fry to mature sufficiently to back cross with the parents. The fry can be fed with rice-bran to help them to grow and can then be transferred to the main fattening pond. The parents should then be separated into sexes, and the two sexes kept separate in the small 40 m^2 acre ponds for three months to prevent them breeding. By this means they will be ready for mating and spawning when used again. During this period they can be fed with rice bran.

The stocking rates for the fry varies slightly with the fertility of the water 1,000 to 1,500/hectare in moderately fertile water, whilst in rich waters, especially with supplementary feeding 2,000/hectare can be used. Above this number the fish are likely to be too overcrowded to grow to a reasonable size. The above methods are worth while observing to produce a good sized fish, and the fish culturist will be amply repaid by carrying out the precautions.

Reducing Water Evaporation

Australian scientists working at the Commonwealth Scientific and Industrial Research Organization (CSIRO), have developed a new method of reducing by half the huge evaporation of valuable water from large storage reservoirs. The new method can be used on large storage reservoir such as those which supply major cities or irrigation projects. Countries and areas where evaporation is high would particularly benefit from the new water preservation method. The new method is simple and inexpensive (it costs about 20 satangs to save a thousand gallons of water). It is a substantial improvement on an earlier method of water savings developed by the CSIRO. With the earlier method, an anchored raft would release hexadecanol which would spread itself over the surface of the water and reduce evaporation by about one quarter. The method of cutting evaporation was only effective on dams up to ten rais which had little surface movement (mainly used in Australia by graziers and farmers). With the new method hexadecanol is still used but with a special machine developed by an Australian engineer, Mr. C.S. Robertson. The machine grinds solid blocks of hexadecanol into a fine powder which is then blown through a tube out the back of a moving boat. The boat moves up and down the reservoir and the powder floats on the water surface to form a thin film, which reduces the evaporation. To lay the first film on the reservoir, the boat must cover the area several times. Hexadecanol has to be added daily but once the film is established, a single peripheral circuit is enough to cause the film to cover the area completely. Eventually no more than half an ounce of hexadecanol an acre is needed daily. By using the boat method an area of a few hundred acres can be fully treated in half an hour. (*News and Information Service*, Australian Embassy, Bangkok, 3 August 1960).

Control Of Water Evaporation

Recent studies on the control of evaporation from exposed water surfaces have been intensified in India at the National Chemical Laboratory, Poona.

The studies suggest that certain compounds known as 'glycol mono alkyl ethers' may be more effective, either singly or in appropriate combination depending on the temperature, than either cetyl or stearyl alcohols. Two of these compounds in tests with evaporimeter pans of 4 and 8 ft. diameter kept in an open field during different seasons and when wind velocity varying from 3-12 m.p.h. showed a reduction of evaporation rate at least 30% better in both summer and winter than with cetyl alcohol. The process for the preparation and use of the new compounds for water evaporation control is now being patented and the results of fundamental studies on various aspects and characteristics of the compounds are to be reported in the near future. (*Nature*, 3 Sept. 1960).

Aircraft Carriers as Fishery Factories

Two aircraft carriers are to be used as factoryships to service the British deep-sea trawling fleet. The carriers have been purchased, along with an on old repair ship, by a British company formed in London. Behind the venture is a firm of shipbrokers and managers, which has been working on project for nearly a year. Capital amounting to more than 12.5 million (US$7 million) is behind the plan. The aircraft carriers are the *Ocean* and the *Theseus*, both 13,000 tons, and the repair ship, *Ranpura* (16,000 tons). Equipment from the latter will be used in the conversion of the carriers and thereafter she will be scrapped. Helicopters will be used to transfer catches from trawlers to the mother-ships, each of which will make four 90-day round trips in a year. On board the motherships the fish will be quick frozen. Products will be sold to distributors on a contract basis. The firm estimates the 50 trawlers will be required to service each carrier. Trawler owners seem to realize that the plan is an excellent one and that it would allow their vessels to spend more time on the fishing grounds. In addition to acting as factoryships, the carriers, each with a complement of 425, will act as servicing ships supplying the catching vessels with fuel, ice, and other requirements. They will have what are described as "shore amenities" for the trawlermen. (*Comm. Fish. Rev.*, May 1960).

Research on Radiation Processing of Foods

Through the stimulus of the Interdepartmental Committee on Radiation Preservation of Foods (U.S.A.), definite steps are now being taken to carry forward a national program of research and development on radiation processing of food. The Atomic Energy Commission (U.S.) has established a program of research and development on low-dose radiation processing of perishable foods to extend shelf life. During the next five, years the Atomic Energy Commission expects to spend approximately $5 million on this project. During fiscal years 1960 and 1961, $115,000 and $500,000, respectively are being devoted to the program. Under the Atomic Energy Commission program, emphasis will be placed on basic studies in food chemistry, microbiology, wholesomeness testing, preservation factors of shelf life extension and radiation processing technology. Over a six-year period, the U.S. Army Research program will cost an estimated $5 million. It also proposes to construct a radiation food research facility to cost about $1.8 million. This facility will consists of a megacurie cobalt 60 gamma irradiator, variable voltage liner electron accelerator, and associated facilities with emphasis on high-dose treatment of food. The Department of Agriculture, Interior, and Commerce

have conducted research and development in their respective areas and indicate they plan to continue their individual programs in cooperation with the Army and the Atomic Energy Commission. The Department of Interior's work is on fishery products. Research on the use of radiation for processing food must take into account the provisions of the several food regulatory acts, such as those administered by the Department of Health, Education and Welfare, and the Department of Agriculture. The wholesomeness and safety of radiation-processed food must therefore be established to the satisfaction of those agencies. Agencies represented, on the Committee are: Department of State, Interior, Agriculture, Commerce, Health, Education and Welfare, Army, Atomic Energy Commission, Small Business Administration, and International Cooperation Administration. As the national research and development program on radiation processing of food progresses, the Interdepartmental Committee through its member agencies will encourage commercial adoption of this technology. (*Comm. Fish. Rev.*, May 1960).

Radiation Preservation of Cod

The storage life of Pacific cod fillets that had been subjected to pasteurization dosages of irradiation and then held at refrigerator temperatures was increased by about three times compared with unirradiated fillets stored at the same temperature. A pasteurization level of irradiation is a level at which most of the bacteria present are destroyed but does not completely sterilize the food. Pasteurized food must be stored under refrigeration. Chemical and bacteriological tests made on irradiated fish during storage indicate that the charges taking place in fish after irradiation are different from those that take place in unirradiated fish. This can be attributed to the fact that irradiation alters the type and number of bacteria that survive, and apparently changes the manner in which spoilage takes place. The usual laboratory tests for freshness cannot be used judge the quality of irradiated fillets of Pacific cod. The judgment of an experienced taste panel therefore was used to compare the quality of the irradiated samples and determine their storage life. These studies were undertaken by chemists at the U.S. Bureau of Commercial Fisheries Seattle Technological Laboratory in cooperation with the Quartermaster Food and Container Institute for the Armed Forces as a part of their program for determining the potential value of ionizing radiation for the preservation of fishery products. All of the irradiated samples tended to have a slight radiation odor and flavor, which is described by most tasters as scorched or burnt. The tests panel could not distinguish among samples of cod fillets that had been subjected to pasteurization at several low levels of irradiation. Samples of Pacific cod that had been subjected to large doses of irradiation, however, were judged to be unacceptable. The approximate storage life of the various samples of cod fillets stored at 32° to 35°F. was as follows:

Control sample (no irradiation)	1 to 2 weeks
0.1–, 0.2–, 0.23–, and 0.46– megarad samples	6 to 9 weeks
0.7–megarad samples	6 to 12 weeks

NOTE: Megarad = 1 million Rads. Rad = The quantity of ionizing radiation which results in the absorption of 100 ergs per gram of irradiated material at the point of interest. Erg = Unit of energy. 1-foot pound = 1,356,000 ergs (*Comm. Fish. Rev.*, April 1960).

Method of Determining Freshness of Tuna

Studies of the deoxidizing anzymes in fish have produced a new method of determining the freshness of tuna. These studies have revealed for the first time the reason for the existence of the dark lateral muscle tissue in such migratory fish as tuna. The migratory fish are much more active than the sedentary fish, and in them the dark lateral muscle tissue performs the same functions as the liver in compensating for this additional activity. When the fish dies, the action of the enzymes decreases. From the degree of this decrease the amount of time the fish has been dead can be determined and this can be used in measuring the freshness of the fish. It is reported that measurements by this method can be made in about five minutes, and it is expected that it will be used in the future for determining the freshness of frozen tuna for export. (*Comm. Fish. Rev.*, April 1960).

Edible Protein from Grass and Oilseeds

Almost any variety of vegetable material can be made to yield protein directly usable as human food by an implus rendering process now in use by a British firm in London. (*Note by the Editor* : This process may be of potential importance in the use of aquatic vegetation such as water hyacinth).

Process. Grass or similar vegetable material is fed into a vessel in which beaters revolve and send strong shock waves through a constantly flowing stream of slighly alkaline water. These waves burst open the cells of the material and release (1) a protein-water solution, (2) carbohydrates, and (3) fiber. Fiber is removed on a virbating screen, washed, dewatered, and made ready for paper or wallboard manufacture. Insoluble carbohydrates are washed and separated from the water by centrifuging. Protein is precipitated from solution with dilute sulphuric acid and collected in a basket centrifuge as a paste containing protein, water, and some oil. This mixture is solvent extracted azeotropically with toluene to dry the protein and to remove all fat.

Products. Grass protein, which is grey-blue in color, has excellent nutritional value for use in soups, meat pastes, sausages, and similar foods. One of the most potentially valuable by products of grass is a syrup containing chlorophyll, carotene, xanthophylls, sterols, steroids, and possibly vitamin E.

Yield and cost estimater. From fresh grass containing 80 percent water, the process will yield about 2.5 tons of pure protein, 7 tons of fiber, and 0.6 tons of chlorophyll syrup. A factory turning out 5,500 tons of protein per annum would need 50,000 kilowatt hours of power per week; however, the fiber produced could be used as fuel to produce some of the power. (*Comm. Fish. Abstr.*, April 1960).

NEWS FROM THE REGION

AUSTRALIA

Shrimp Industry:

At an estimated catch level of 6.5 million pounds (heads on) in the fiscal year ending 30 June 1960, the landings would be down slightly from the preceding fiscal year total of 6.8 million pounds. There are about 150 vessels engaged full time in the Australian shrimp fishery. These vessels range in size from 30-60 feet in length with motors up to about 350 horsepower. During the peak shrimp fishing season, the fleet increases to about 200 vessels. Prices being paid to the vessels for exportable sizes of shrimp (mostly 21-25 count) were from 39-42 U.S. cents a pound. Catches of shrimp are sold ungraded. Total costs for processing shrimp for export amount to about 23-24 cents a pound, including all costs to point of shipment other than storage at point of export. This latter cost, if incurred, would increase the total cost by 1 or 2 cents a pound. Additional costs to the distributor's level in the United States would include ocean freight, insurance, handling, storage, and broker's commission. Australian statistics do not list the value of shrimp exports as those exports are combined with exports of other shellfish in the export statistics. The Australian Fisheries Division of the Department of Primary Industry estimates that exports for the fiscal year ending 30 June 1960, will be about 450,000 pounds of headless shrimp, or about 5 percent higher than the 1958/59 fiscal year exports of 427,000 pounds. There are no taxes or other export restrictions imposes on the shrimp exported from Australia. Under the Exports Regulations, shrimp must be processed in an establishment approved by the Government. The regulations prescribe certain sanitary requirements, freezing times, and maximum temperatures for freezing and storage. Inspectors for the Government insure compliance with the regulations. (*Comm. Fish. Rev.*, April 1960).

Australia and Indonesia in Biggest Sea Survey

Australia and Indonesia are to cooperate in the biggest oceanographic survey ever undertaken in South-East Asia. The survey is to be carried out from the Royal Australian Navy training and oceanographic research frigate, H.M.A.S. DIAMANTINA, by naval oceanographers, scientists from the Australian Commonwealth Scientific and Industrial Research Organisation, and possibly a group of Indonesian researchers, and would reveal the secrets of some of the world's least explored waters. H.M.A.S. DIAMANTINA will steam a total of more than 17,000 miles on the cruise and would survey vast areas of the Indian Ocean, the sea around the Indonesian archipelago and the waters between Indonesia and Australia. The survey will be of mutual interest and benefit to both countries, and is a preliminary to the UNESCO multi-nation Indian Ocean survey planned for 1962. The Indonesian Government has been invited to put scientists on board H.M.A.S. DIAMANTINA (*News and Information Service*, Australian Embassy, 18(28), 1960, p. 3).

BURMA

The Burmese Government Defense Services Institute (DSI) has established a joint fishery venture with a Singapore fishing company. Deep-sea fishing operations about 80 miles off the coast of Mergui (East of the Andaman Islands) were started in October 1959 with 14 motor trawlers from Singapore. The DSI takes 65 percent and the company 35 percent of the catch. The vessels are manned by about 100 Chinese fishermen from Singapore, with about 80 Burmese undergoing training. It is reported that the number of trawlers is to be increased to 50, and that the area of operations will be extended to waters off the Arakan coast. During the fourth quarter of 1959 an official of the Institute, during his trip to Europe, arranged with the Norwegian Government for a deep-sea fishing survey in Burmese waters. Arrangements were also made to send Burmese to Norway for training in deep-sea fishing. The Government recently issued over US$3 million in import licenses for fish, with the Army Fisheries Project the sole purchasing agent. The DSI hopes that the survey and training of Burmese will ultimately enable it to fulfill Burma's fish requirements from an entirely home-based industry, under DSI control. (*Comm. Fish. Rev.*, July 1960).

CAMBODIA

A new Department of Fisheries has been created in the Ministry of Agriculture of the Government of Cambodia. It is expected that this step constitutes an important progress in the development of the fisheries of Tonle'Sap, and the Mekong and its tributaries, as well as fish culture.

CEYLON

The Extension Service News Letter No. 21 dates 31 May 1960 gives the following information:

Mechanization:

An additional 46 mechanized boats financed by Government Funds were launched during the months of April and May. Of the 46 boats launched 17 were assigned to Fisherman's Co-operative Societies and 29 were given to individual fishermen. This brings the total number of mechanized boats financed by Government Loans to 253; i.e.—175 to individual fishermen, and 78 to Fishermen's Co-operative Societies. Most of the mechanized boats that were operating in the West Coast during the last fishing season have now migrated to the East Coast with the setting in of the South West Monsoon. A large number of boats from Negombo have, however, not migrated.

Multiple Hook Trolling:

This method of fishing was first tried out in the South by the fishermen of Kudawella and Tangalle in 1957 when large shoals of 'Skipjack' were found off this coast. The fish were small, the average weight being only about ½ lb. each. The old method of trolling six lines with two hooks to a line was found to be slow as several runs had to be made to get an appreciable catch. The fishermen, therefore, experimented by using a few more hooks to a line and as this proved successful, the number of hooks

to a line were increased. Towards the end of that season fishermen were using as many as 30 hooks to a line. The following year heavier lines were rigged up for 'Paraw', 'Seer' and 'Tuna' and proved to be very successful. Today, multiple hook trolling lines are used for all types of fish. The use of the single or double hooked line has practically ceased in these centres. The multiple hook trolling line is made with monofilament nylon. The nylon for the branch lines is about two sizes smaller than that used for the main line. The number of hooks per line varies from 10 to 30. Normally the heavier lines carry a smaller number of hooks than the lighter lines. The hook is tied to the nylon without the use of a wire trace. The lure used is the local equivalent to the 'feather Jig'. No diving board is used. Care must be taken in the operation of these lines, especially the heavy lines. Serious injury can be caused to the operator, mostly as a result of sharks attacking the fish caught on the line and pulling the line out after it is half in. In the lighter lines the damage is less as the line may give way. When training fishermen in this mothod at first not more than 10 hooks per line should be used and only two lines run out.

Engine Maintenance Course No. 16

Mr. E.R. Kvaran, Marine Engineering Superintendent F.A.O. attached to the Department of Fisheries conducted a course in the operation and maintenance of marine diesel engines at Kalmunai from 18th to 30th April, 1960. He was assisted by Mr. M. Krishnapillai–Extension Officer, Batticaloa. Twenty one trainees attended this course.

INDIA

Shrimp Industry:

The shrimp fishery of India has in the past been confined largely to the shallow coastal waters (chiefly South India) and the catches are mostly small immature shrimp plus smaller quantities of the larger sizes. Biological surveys by the Government have indicated that the older shrimp inhabit the deeper waters. Evidence pointing to the presence of such shrimp in deeper waters has been afforded by the catches of large shrimp by pilot fishing trawlers of the Indian Government. Increased mechanization envisaged under the country's Second and Third Five-Year Plans is expected to help develop marine fishing by extending operations far beyond the present limits, and to increase the volume and change the character of India's shrimp catch.

***Landing*:** The shrimp landings are considerable. (Term "shrimp" as used includes prawns and lobsters and no differentation is made in the Government statistics.) According to official statistics, landings amounted to about 20,000 metric tons during the first three months of 1959 and the total for the year was expected to be close to the 1958 landings of 85,200 tons. The landings for 1957 were reported to be about 136,812 tons and for 1956 close to 159,600 tons. In addition to the ocean catch, considerable quantities are caught in lagoons, estuaries, and fresh water for which reliable statistics are not available. No statistics on the value of the shrimp catch are maintained.

***Fishing Fleets*:** No data on the number of vessels solely employed in shrimp fishing are available because of

the fact that the use of a fishing vessel in India generally is not confined to catching any particular species but catches many types of fish. In 1959 there were about 95,000 nonpowered and about 1,600 mechanized vessels in the marine fishing industry. The mechanized vessels are divided among the coastal state about as follows: 1,300 in Bombay, 200 in Kerala, 50 in Madras, 30 in Mysore. 25 in Andhra Pradesh, and 10 in Orissa.

High priority is being given to the mechanization of fishing vessels, establishment of vessel-building yards, the supply of improved fishing gear, and provision of shore facilities for handling catches, The Third Five-Year Plan (1961–66) target for mechanized vessels has been tentatively placed at 5,000 vessels.

Prices: The Ministry of Food and Agriculture states that ex-vessel prices differ widely from place and the approximate average ex-vessel price of shrimp is about Rs. 25 a hundredweight (5.25 U.S. cents a pound). According to the *Bulletin of Agricultural Prices*, the market prices of shrimp in October 1959, averaged about Rs. 84.00 (US$17.64) per 100 pounds at Bombay and Rs. 68 (US$ 14.28) per 100 pounds at Madras.

Exports: Current export prices by types and sizes are not available, but export quantity and f.o.b. value statistics for the first half of 1959 indicate an average price of Rs. 164 ($34.44) per 100 pounds, as compared to Rs. 148 ($31.08) in 1957 and Rs. 172 ($37.16) in 1958. The average value of shrimp exports (includes frozen, canned, dired, etc.) to the United States has been considerably higher than the average for export to all countries—Rs. 223 ($46.83) in 1957. Rs. 242 ($50.82) in 1958, and Rs. 224 ($47.04) in January–June 1959 per 100 pounds. The composition of shrimp exports compared to total shrimp production accounts for the wide difference between average domestic market prices and average export prices.

Taxes: There are no restrictions on the export of shrimp. However, the Government levies a tax of Rs. 0.75 (about 16 U.S. cents) per 100 pounds an all shrimp exported from India. (*Comm. Fish. Rev.*, May 1960).

Report of Fishing Experiments in the Offshore Waters of the Madras State,

by V. John and others, 55 pp,. illus., printed. Controller of Stationery and Printing, Madras, India, 1959. Reviews the accomplishments of the Madras Fisheries Department in experimental deep-sea fishing, particularly since 1954. Covers the history of exploratory fishing off both east and west coasts of Madras; trawling surveys conducted between 1927 and 1931; the shark fishing industry; experiments; utilization of deep-sea catches; application of cold in preservation of fish both on-and offshore; handling and storage aboard vessels; and transport of fish on land. It also covers preservation of fish by curing, pickling, smoking, and byproducts such as fish meal, fish oil, fertilizer from offal, and shark-liver oil. (*Comm. Fish. Rev.*, April 1960).

Exports of Fish and Shellfish from Cochin, 1956/57-1958/59:

All of the frozen shrimp exported from South India to the United States is shipped via the port of Cochin. Shrimp exports from this port are included under the category "fish and prawns." Exports to the United States under this classification in fiscal year 1958/59 (july 1-June 30) amounted to 1,351 short tons valued at US$1,119,000, as compared with only 505 tons valued at $509,000 in fiscal 1957/58

and 595 tons valued at $495,000 in fiscal 1956/57. Exports to the United States of fishery products other than frozen, dried, or canned shrimp, and spiny lobster tails are negligible. In addition, India also exports some frog legs to the United States which are probably not included in India's statistics on exports of "fish and prawns".

All four South Indian states (Kerala, Andhra Pradesh, Madras, and Mysore) have programs for fishery development. The implementation of these programs for expansion of fisheries should result in greater landings.

Exports and Imports of Fishery Products, 1959:

Exports of fishery products by India in 1959 amounted to 61.1 million pounds, valued at about US$12.9 million. Principal countries of destination were Ceylon, Singapore, United States, and the United Kingdom.

Imports of fishery products by India in 1959 totaled 34.3 million pounds, valued at US$6.1 million. Imports from East and West Pakistan made up about 70 percent of the total imports in 1959.

In 1958, India's exports of fishery products were close to 64.3 tons, valued at $12.2 million; imports totalted 24.3 million pounds, valued at $4.3 million.

The United States share of India's export trade in fishery products in 1959 amounted to about 3 million pounds valued at about $1.4 million (exclusive of frog legs, which according amounted to 182,000 pounds in 1959). Exports to the United States included 2,292,000 pounds of shrimp, 62,000 pounds of canned shellfish (mostly shrimp), 541,000 pounds of unclassified canned fish, and 153,000 pounds of other shellfish (presumably spiny lobster tails). Other items exported to the United States amounted to about 7,000 pounds and probably consisted of Oriental specialty items. Exports of fishery products to the United States made up 4.4 percent of the total quantity exported and 10.7 percent of the value of all fishery exports. (*Comm. Fish. Rev.*, July 1960).

INDONESIA

Shrimp Fishery:

Although there are no Indonesian statistics on shrimp landings, observers have reported the presence of substantial shrimp resources in Indonesian waters, both small shrimp in coastal waters and large shrimp farther out to sea. However, no facilities exist to market efficiently the light landings of shrimp. Nor are there facilities for increasing the catch. There are no foreign companies engaged in shrimp fishing in Indonesia. It is estimated by the International Cooperation Administration Fisheries Advisor that approximately one-half of the shrimp catch is for immediate use and that the remainder is sold commercially. Shrimp is readily available in restaurants. The Fisheries Advisor estimates that more than one million pounds of shrimp per month could be produced if the facilities were available. However, nothing is presently being done to develop or assist the commercial development of the Indonesian shrimp resources. (*Comm. Fish. Rev.*, July 1960).

Raising Shrimp in Ponds:

A Japanese corporation, with head offices in Tokyo, is building Japan's first hatchery and rearing plant for "kuruma" shrimp (*Penaeus japonicus*) in abandoned salt ponds at Takamatsu in Kagawa Prefecture. The complete rearing of shrimp from the egg to the adult stage is planned. The shrimp farm is also an example of a way to utilize abandoned solar-salt beds. Japanese aquiculture in shallow marine waters has been expanding rapidly. According to the 1958 fishery census, if 1953 is taken as 100, the 1958 production index for "nori" (laver) was 147, and for oysters was 150. However, "kuruma" shrimp rearing has been an exception in that the increase in production has been slight. There are various reasons why shrimp rearing has not developed, but the principal ones are (1) the only source of young stock has been from natural spawning and it has been very difficult to obtain, and (2) the supply of rearing stock has been so limited that its price has been high. If seed shrimp could be obtained easily and cheaply, shrimp rearing would expand.

The president of the firm (former chief of the Research Division of the Japanese Fisheries Agency) experimented for more than 10 years at his laboratory in Chiba Prefecture on the complete rearing of "kuruma" shrimp and finally succeeded in complete artificial propagation from the egg to the adult stage. Since there were prospects for commercial success, a corporation was formed (capitalization 35 million or US$97,000) with the support of two large Japanese fishing companies. Commercial facilities are to be established for hatching and rearing shrimp in abandoned salt beds on the Inland Sea of Japan. Larval and juvenile shrimp for rearing will be supplied to coastal fisherfolk at reasonable prices. Thus the company's operations will aid the development of shrimp culture and contribute to the prosperity of coastal fishery enterprises by solving the problems of difficult supply and high prices of seed shrimp.

The old salt beds which is to be used for shrimp rearing are located west of Takamatsu, close to the large consuming area of Kyoto, Osaka, and Kobe. The 11 hectares (27 acres) of salt beds near Takamatsu was found to be the most suitable place. Facilities will include 89,000 m^2 meters of rearing ponds, 1,800 m^2 of nursery tanks, sea-water intake and drainage lines, filtering installations, a 60-ton water tank in addition to the existing 300-ton tank refrigerated storage, feed preparation shed, laboratory, office, and living quarters. Construction was scheduled to be completed by the end of March 1960.

The corporation was to begin shrimp rearing in April. According to operating plans, the eggs will be taken from breeding stock (300,000-700,000 eggs per spawner) and will be placed in hatching tanks with apparatus for regulating the temperature. It is now possible to hatch and rear as many as 10,000 shrimp. The larval shrimp will develop in nursery tanks until June, then will grow to adult size in rearing ponds, and the first shipments will be ready for market in the autumn. It is planned to produce about 25 metric tons in 1960. The scope of the facilities will be increased progressively, and plans call for production of 225 tons in the second year, 3,000 tons in the third year, and 10,000 tons in the fifth year.

For the present, the shrimp will be put on the domestic market, but future plans call for export to be United States.

In order for any form of aquiculture to develop as a modern industry, it must have the following elements: (1) the organism to be reared must have a short culture period and have a high commercial value; (2) production in large quantities must be possible; (3) it must be possible to lower the cost of production by technical progress; and (4) it must be possible to lower production costs by large-scale production and still leave possibility for further expansion. Most of the forms of aquiculture practiced at present do not have these factors, and they are not therefore developing into modern industries. For example, "nori" (laver) culture is producing a fairly large harvest, but the form of business organization is undeveloped and the industry has developed simply as an aggregation of very small enterprises (large as a part-time occupation of coastal fishermen or farmers). On the shores of the Inland Sea the rearing of yellowtail has developed very rapidly in recent years, but because of the rapid increase in facilities and production, supply has exceeded demand, the price has dropped, and this year there are many operators who are losing money. Rainbow trout rearing, which has undergone an astonishing expansion in inland waters, is limited by environmental factors related to the water supply and is not suitable for a large-scale industry. The plan of the Japanese shrimp corporation for complete rearing of shrimp has all of the necessary elements. At present the total production of cultured shrimp is only 150 tons.

All of the prefectures around the Inland Sea have been trying to find ways of utilizing the abandoned salt beds of that area. According to the Japanese shrimp corporation, out of total of 1,400 hectares of abandoned salt beds, about 500 hectares offer the proper conditions for rearing "kuruma" shrimp. Just by turning the shrimp loose in the salt ponds, a production of 3.75 kilograms per hectare is possible. The corporation is encouraging the use of the abandoned salt beds for rearing shrimp and plans to supply seed shrimp at reasonable prices. It is also offering its plans to the prefectures around the Inland Sea and to salt companies in the area, showing them how shrimp calture can offer a new use for the abundant unused land and disused salt beds around the Inland Sea coast.

The Japanese Fishery Agency has been working on its plans for developmental financing in the 1960 fiscal year. Included in the plans is a loan for the "kuruma" shrimp rearing facilities. Of the total capital of Y52 million ($144,000), Y20 million ($56,000) is scheduled to come from the Development Bank. (*Comm. Fish. Rev*, May 1960).

Winter Albacore and Indian Ocean Tuna:

Since mid-February landings of winter albacore at the port of Shimizu have been good and from 2,000–3,000 large albacore (between 24–33 pounds each) were landed every day and were bought by the canners. These winter albacore were landed by about 35 boats from Kushikino, Kagoshima Prefecture, which reported good fishing and are now based at Shimizu. These fish from nearby waters were sold at the high price which has prevailed since the end of 1959. At the same times, tuna boats were coming in from the Indian Ocean one after another. According to their reports, this year three times as many boats are fishing in that area, but catches appear to be good. The

port of Shimizu also received landings every day of Indian Ocean bluefin. In December 1959 there were landings of 131 tons of Indian Ocean bluefin and albacore by four boats from Mie and Kagoshima Prefectures, and the bluefin sold for 533 to 3,850 yen per 10 kg. (US$148–1,069 a metric ton), the southern albacore at 850–950 yen ($236–264 ton), and local albacore at 910–1,050 yen ($253–292 a ton). The Japanese vessel *No. 2 Wako Maru* (260 tons gross), which is famous for big landings of Indian Ocean tuna, sailed December 26, fished for 9 days, from January 13 to 21, caught 116 to 342 Indian Ocean bluefin each day, and made a quick trip back with 80 metric tons of tuna. The fishing took place at 23°–26°S., 101°–107°E. in surface water temperatures of 21°–22°C. (69.8°–71.6°F.). Although there are three times as many boats fishing in that area as last year, catches are good, with all boats taking 4 to 10 tons a day. It is anticipated therefore that landings of Indian bluefin will continue at a good level for some time. (*Comm. Fish. Rev*, April 1960).

Canned Tuna in Oil Exports:

Japanese exports of tuna canned in oil from April to December 1959 amounted to 1,136,000 cases exported during the same period of the preceding year. Of this total, white meat accounted for 156,000 cases (115,000 the year before) and light meat for 980,000 cases (484,000 cases the preceding year). Exports in actual cases from April-December 1959 went to (1958 figures in parentheses): Germany 344,772 (188,828), Canada 103,864 (86,852), United Kingdom 102,457 (40,791), Saudi Arabia 88,428 (44,907), Belgium 79,325 (49,289), Lebanon 78,608 (22,105). Netherlands 68,998 (47,913), Syria 66,130 (1,179). Total (omitting smaller markets)–1,136, 863, cases (599,886). Total exports for the calendar year 1959 were 1,346,792 cases. Very little tuna canned in oil is exported to the United States. (*Comm. Fish. Rev.*, April 1960).

Squid Landings in 1959:

According to the Products Section of the Hokkaido Fisheries Department, Hokkaido's squid landings for 1959 reached 265,000 metric tons, the highest since 1954. Up to the end of the war the Hokkaido squid catch never exceeded 70,000–80,000 tons, but then the "squid boom" began, with catches of 135,000 tons in 1947, 208,000 tons in 1948, 232,000 tons in 1949, 290,000 tons in 1950, 310,000 tons in 1951, 264,000 tons in 1952, 234,000 tons in 1953, and 266,000 tons in 1954. From 1955 on for several years the catches dropped to about 140,000–180,000 tons, but they appear to be increasing again. The amount of squid shipped fresh out to Hokkaido in 1959 was 19,433, tons, an increase of 4,500 tons over the preceding year. Fresh squid consumption within Hokkaido was 12,500 tons, up 4,400 tons over 1958. Per capita consumption in Hokkaido was 2.5 kilograms (5.5 pounds); 146,861 tons were used for drying; 60,774 tons were frozen; and 24,758 tons were used for salting, smoking, canning etc., making a total of 232,294 metric tons of squid that were processed in Hokkaido. (*Comm Fish. Rev.*, April 1960).

KOREA

Fisheries Development:

The Combined Economic Board in South Korea in mid-March 1960 approved the release of counterpart funds for financing of irrigation projects, and also earmarked US$700,000 of International Cooperation Administration salable imports for fisheries supplies for South

Korea's fishing industry. According to data released by the South Korean Office of Marine Affairs, a total of $17 million of United States aid funds has been allocated for fisheries Development since 1953. The money was about evenly divided between investment projects and imported supplies. The fishing industry suffered severs damages in the typhoon of September 1959, when nearly one-third of the total fishing fleet was destroyed. Second to housing, fisheries rehabilitation is receiving highest priority in allocation of typhoon relief funds.

Fishing Industry Hit Hard by Typhoon

The havoc of Typhoon Sarah which hit Korea in September 1959 is estimated to have cost the fishing industry fully one-fourth of the potential production of 1959. Out of a fleet of 37,000 fishing craft, 11,000 or nearly one-third were totally destroyed and numerous other vessels were damaged. With so many vessels out of commission during the fourth quarter, what is generally a highly productive season (especially for the anchovy and mackerel fisheries), 1959 marine production of 382,125 metric tons was off 3.3 percent from 1958 whereas development before Sarah struck in September had warranted expectations of peak postwar output. Despite the unavoidable decline in the production, 1959 exports of all varieties of marine products, valued at US $4 million, were the highest since 1953. An unusually good crop this winter of laver (seaweed), which normally commands premium prices in Japan, portends continued progress of the marine-products category as an important earner of foreign exchange—assuming an early normalization of Korean-Japan trade relations, for Japan has been the sole purchaser of Korean laver and the major customer for all categories of marine exports. Rehabilitation of the fishing industry is receiving high priority by a committee concerned with typhoon reconstruction. With over $1 million in United States funds and 681.5 million hwan ($524,000 at the rate of US $1 = 1,300 hwan) allocated by Korean Government, it is planned to construct 8,453 small craft (under 5 tons). A long-term, low-interest loan program is enabling individual fishermen as well as the fishery cooperative and associations to resume their operations. (*Comm. Fish. Rev.*, May 1960).

FEDERATION OF MALAYA

Japanese Vessel Lands Tuna

The *Koshin Maru No. 5*, the first Japanese tuna fishing vessel to be sent to sea by a jont Malayan-Japanese fish canning firm, returned to Penang on 10 February 1960, from its initial trip in the Indian Ocean with a catch was 7 tons over the quota for the trip. Very little of the catch was expected to be sold locally. The greater part is to be canned or frozen for export. Upon hearing of the success of the first trip, the company's managing director stated that the company did not intend to compete with any offshore fishing operations by Chinese and Malaya fishermen in the Malayan Federation. The Minister of Agriculture stated that his ministry would see to it that the livelihood of the offshore fishermen, already near the bottom of the income scale, was not thrown out of balance. The Minister announced that the Malayan-Japanese company, the Government, and the fishing cooperatives were developing a plan for

the training of selected local fishermen in deep-sea operations. (*Comm. Fish. Rev.*, April 1960).

The Quarterly Progress Report of the Fisheries Department for the Second Quater of 1960 – gives the following information :

Fish Landings

The total fish landings for the whole of the Federation in the second quarter of 1960 (663,000 piculs) show an increase when compared with those for the corresponding quarter of 1959 (578,000 piculs) and the first quarter of 1960 (429, 000 piculs). The increase in landings over the previous quarter in the East Coast States of Kelantan, Trengganu and Pahang is to be expected following the cessation of the North East Monsoon. The Pangkor purse-seine fleet, Perak, landed substantial amounts of kembong and chincharu in May and compensated for the poor performance of the stakes and the pukat jerut fleets of Kedah when bad weather interfered with fishing in the latter part of the quarter. In the South West the drift netters had a satisfactory season, but the stakes as elsewhere along the West Coast did not do well. In the North East landings increased substantially in May when compared to the same month last year. Pukat tangkol fleets in May, fishing at night with gasoline lamps, landed more tamban beluru and tamban sisek than in the corresponding month last year, while pukat dalam and pukat tarak also landed more. Towards the end of the quarter, pukat tarek and pukat jeroot landed large quantities of bilis. Pukat hanyut and handlines had a lean season throughout the quarter due to scarcity of tenggiri in the area. In the South East, a fall in landings of 6,000 piculs in Pahang and 10,000 piculs in Johore East was recorded as compared to the corresponding period in 1959. The Pukat Cheroot Bilis and Tarek in Pahang landed considerably less compared to name period last year, but pukat tangkol landings increased substantially in May and June.

Developments in Gear Technology

In the North West lamp-fishing by pukat jerut fishermen is an interesting development. Make shift lamps are submerged to a fathom or so over an old stake site and allowed to drift with the current. The lights would act as lures and a net is shot round the lamp. A somewhat similar technique is employed by pukat tangkol fishermen who use gasoline lamps hanging from the fifth boat or especially made rafts to attract the fish. Technical details about lamp-fishing are under study by a Japanese Fishing Expert. Preparations are under way to hold a demonstration to Kuala Kedah fishermen during which the expert will experiment with more powerful lamps (three 500 watt bulbs and six 36 watt bulbs). In Trengganu this type of fishing was carried out at night without the use of unjangs whatever, and has been very successful.

The Moro-Ami unit, belonging to the Moro Ami Kongsi Pantai Timor, commenced fishing in early April.

In Kuala Trengganu a synthetic drift net fishermen designed out of his drift net a special net called pukat rapang (mullet). An additional line of floats is attached to the middle of the net and bamboo bars are inserted at 4 fathom intervals to open up the net centre. Weights are tied to the foot rope of the lower section of the net which acts as

the wall. The net is drawn towards the shore and the fish on being confronted with the net will jump over and land in the trough formed by the two lines of floats.

A new pukat jerut bilis, 360 yards long and 34 yards deep made entirely of synthetic fiber Saran N was introduced at Kuala Ibai in June. The net costing $6,500/—has proved fairly successful, and orders have been placed for eight more of them.

Mechanisation

The rate of mechanisation in the North West has been more rapid in Perak and Perlis than in Kedah and Penang where fishing activities have been relatively restricted. In the South West Zone, the pace has also slowed down following the imposition of restrictive licensing on drift-net fishermen. In South Selangor however, while only 22 powered boats were registered in the first quarter of this year, there were 48 new powered boats registered between April to June. In the North East 86 new boats with inboards were registered in the quarter under review, compared to 48 in the same period in 1959. The corresponding figures for outboards are 5 and 3. As expected fishermen began building their boats towards the end of monsoon and had them completed arouud April and May in time for the fishing season. In the South West there were eight new boats constructed and powered with inboard engines, and the tendency towards bigger and high-powered boats for bubu operators was particularly marked during this period. The number of new boats would have increased considerably had it not been for the cancellation of loans to the fishermen under the Fishing Aid Scheme.

Fishermen's Co-operatives

The number of Co-operative societies in the East Coast stood at 41, with a membership of 2,886 (excluding co-operatives in the Kuantan district). The East Coast Transport and Marketing Union marketed 3,000 piculs of fresh and 1,000 piculs of cured fish in the quarter under review.

The growing importance of the Union in negotiating for supply of materials to co-operatives at preferential rates is reflected in the supplies of diesoline, petrol, kerosene, cylinder oil, gear oil, ice, rattan and wire netting to member societies.

Fisheries School

The second course for 1960 in the care and maintenance of Engines, in Helmsmanship and training at sea, was held from April 4th to June 24th. At the end of the course examinations, the results were

Engine Care and Maintenance 16 sat 14 passed.

Engine Drivers' 3rd Class Certificate 13 sat 13 passed.

Helmsmanship of a Fishing Boat 10 sat 5 passed.

The distribution of trainees was as follows:— Pahang 4, Selangor 2, Perak 3, Perlis 1, Trengganu 6, Armed Forces 1.

The new school building at Glugor has been completed and it is expected that the new accommodation will shortly be put into use. The modern buildings and equipment, and the added space will enable a bigger intake of candidates, and a more comprehensive training programme.

The Fisheries School at Sebrang Takir in Kuala Trengganu was completed

in June of this quarter. The school will take in 30 students at each 3-month course.

Freshwater Fisheries

The following number of fish fry were distibuted during the quarter, to various areas in the Federation :

Lampam Jawa . .	45,420
Lee Koh . .	7,145
Kalui . .	14
Tilapia . .	3,400
	55,979

Limited supplies of fry and transport difficulties have restricted the stocking programme but both of these difficulties are being rectified. The first by rearing large numbers of recently hatched fry to suitable size for stocking, and the second by the provision of additional transport facilities. An increasing number of fish farmers are being made independent by providing them with mature lampam jawa suitable for breeding. This programme enables the Department's ponds to be used to carry out research and experiment on the type of fish which appears suitable for pond culture, particularly indigenous river fishes. 36 ponds covering a total of 36.15 acres were cleared for stocking by the Department in the quarter. In Trengganu a number of Drainage and Irrigation canals were stocked with *Tilapia* fry and Shell Endrex was used in new ponds to prepare them for fry. In Malacca, Junior Fisheries Assistants undertook a survey of the Malacca River with a view of stocking the River with suitable fish-types. In Pahang aborigines who started fish farm with free fry supplied by the Department have expanded their activities considerably in this direction. Many applications are being received for the use of abandoned mining pools in the Taiping area as a result of the Department's advice and demonstration on how to make the productive.

Research Activities

Cockle Culture

Routine examination of gonad and salinity have continued. Plankton hauls and examination of bottom mud at the natural bed at Kuala Jalan Bharu were started in late June as this is the period when spat begins to appear.

A proposed site for cockle culture at Telok Tempoyah was examined and a report on the salinity of the site for cokle culture was submitted.

Work on the hydrological conditions of the Pangkor fishing grounds has continued. The chemical and physical examination include temperature, pH, salinity, oxygen content, nitrates and phosphates.

The determination of the salinity pattern in the North Malaca Straits begun in April 1958 was completed in April of this quarter, thus completing the study of the salinity pattern of the West Coast of Malaya. It is hoped that the salinity pattern of the seas off Kedah and Langkawi would soon be attempted to give a more detailed picture of the salinity distribution in the West Coast.

Hydrological observations of the water quality in the fish farm at Bayan Lepas were completed in April. The completed data is being analysed to show the seasonal variation in the water quantity.

Rastrelliger Fisheries

As during the last quarter, studies on growth, gonad development, plankton and salinity were continued. Gonad in

stages III and IV of maturity stage, were examined for fecundity.

Plankton Hauls

Preliminary work on the calibration of flow meters for the Marutoku and Clarke-Bumpus plankton samples were made prior to experimental planktonic work with these nets.

Experimental Fishing

Three members of the staff accompanied the Japanese Fishing Vessel KAGAWA MARU to conduct experimental fishing with a bottom otter trawl covering the area from West of Langkawi to the Pulau Sembilan Islands.

Food Technology

The analysis of ikan talang, merah and yu under different conditions of storage and humidity were continued in the quarter under review. The rate of decomposition in relation to the quality is being determined by estimating the total volatile Nitrogen (T.V.N. value) of weighed sample of salt fish at regular intervals. It is hoped to formulate a chemical means of grading fish according to its keeping quality.

Freshwater Fisheries

Research into Udang Galah has been continued in the second quarter of 1960. In particular intensive studies of moulting, mating and spawning were undertaken. In addition two field studies were made, the first in conjunction with the utilisation of land for prawn culture and the other on industrial pollution in rivers. The Seberang Perai Co-operative Banking Union has proposed a scheme for utilisation of a law-lying area in Bertam Estate for prawn culture. Preliminary investigations have showed that of the 7,000 acres of estate land, 2,000 acres are low-lying and suitable for prawn culture, but detailed studies of the biology of the freshwater prawn are still continuing.

Pollution studies of the Lukut River in Negri Sembilan were carried out in the quarter under review, to determine more fully the pollution effects of the effluent from rubber estates. Samplings were made in the field with the help of a boat loaned from the Forestry Department, and effluent samples were also brought back to the laboratory for toxicity and other studies.

Experiments on the transport of fish-eggs were undertaken at the Tapah Station. Common carp eggs, which are ideal for this experiment as they are attached to fibres after spawning, were packed under moist conditions in plastic bags which were filled with oxygen. Of the first batch transported to Taiping for stocking of the Taiping Lakes, about 80% hatched out successfully.

Training in Fish Culture

Nineteen farmer trainees from Perak, Pahang, Trengganu and Kelantan attended a fish culture course held at Headquarters Penang and at Tapah during May 1960.

PAKISTAN

Abolition of Duty on Fishing Equipment:

Following the abolition of duty on imports of fishing equipment, thus putting it on a par with agricultural equipment, the marine boat-building business boomed in the East Pakistan ports of Chittagong and Khulna. A fishing firm

in Cox's Bazar started deep-sea operations. sending the catch to Chittagong in "cold-storage" vessels. Arrangements are being made for freezing, channing, and exporting of fish from Chittagong and Khulna. The first shipment of frozen shrimp from East Pakistan to the United states was also made.

Shrimp and Other Fisheries:

Pakistan exports of frozen shrimp to the United States have climbed from 150,000 pounds in 1956 to 471,000 pounds in 1957 and 637,000 pounds in 1958. Twelve commercial trawlers are under construction by private individuals. Previously no commercial trawlers were in operation in Pakistan. United States Operations Mission-Pakistan has, through its aid in constructing a modern fish harbor at Karachi and encouraging the exploitation of fishery resources particularly by the private sector, been instrumental in the recent expansion of the fishing industry in Pakistan. Since October 1959, when the fish harbor and market was officially opened, an average of 100 metric tons of fish have been auctioned daily through the market. (*Comm. Fish. Rev.*, May 1960).

Shrimp Industry:

The Pakistan shrimp catch the last quarter of 1959 at times was so large that the freezing plants were glutted and facilities for drying and curing were unable to absorb the excess. As a result, there was a sharp drop in prices of shrimp. Since about six additional trawlers had gone into operation during the quarter, the Government suspended for a while the operation of its trawlers so as not to compound the difficulties by bringing in additional shrimp. In the first quarter of 1960 it is expected that the freezing plant located within the area of the fish harbor at Karachi will be put into operation and thus will increase the freezing capacity by 15 tons daily. The shrimp drying and curing areas are also being expanded. During the first quarter of 1960, however, at least six mere trawlers will be added to the fleet.

Fisheries Trends, February 1960:

The first fish freezing, processing, and canning plant in East Pakistan was scheduled to start operations early in 1960. This plant, operated by a fish preservation and marketing corporation and located at Chalna, is heralded as another foreign exchange earner. New tuna fishing grounds have been discovered in the Bay of Bengal, but their potential has not been fully determined. (*Comm. Fish. Rev.*, April 1960).

The Monthly Progress Report of the Central Fisheries Department for the Month of June/July 1960, gives the following information:

Fish Harbour:

Whole-sale Fish Market which is situated in the Fish Harbour is being operated as usual under the Karachi Fishermen Cooperative (P. & S.) Society Limited.

Construction of Laboratory Building:

About 99% of the work has now been completed.

Fisheries Development, West Pakistan:

Due to the Monsoon Season fishing operations have been suspended and the vessels have been returned to the

Fisheries Department by the Karachi Fishermen's Cooperative (P. & S.) Society Limited. Minor repairs of both the vessels are going on. The auxillary engine of M.F.V. "New Hope" has been dismantled for over-hauling. Estimates of major works of engine-room & deck of M.F.V. "New Hope" have been prepared. Efforts are being made for dry-docking of M.F.V. 'Machhera'.

Distribution & Sales of Fishing Requirements:

Four Marine Diesel Engines (three of 40 H.P. and one of 30 H.P.) during June and 2 Diesels during July have been issued by the Fishermen's Cooperative (P. & S.) Society Ltd. during the period under review. The following fishing articles have been sold to the member-fishermen by the Karachi Fishermen's Cooperative Society Ltd. Coir Ropes Nylon Twine, Teak Wood, Katacha Spongex Floats, Spare parts.

Fisheries Development Mekran Coast:

Construction of 10 launches under mechanized fishing scheme and two fish carrier vessels are marking good progress. The construction of a trawler, under shell & Sardine Scheme, is nearing completion. Construction of Curing Yard at Pasni is in progress.

Fisheries Development East Pakistan:

Construction of fish Market, Cold Storage Ice Plant at Chittagong is progressing well.

Operation of Mechanized Fishing Fleet:

All the boats are out of operation due to the moonsoon weather, except two 60 feet and two 32 feet boats, which are engaged in fishing carrying operation in Khulna area. The other boats are undergoing annual repair.

Construction of 12 Mechanized Fishing Boats:

Due to heavy rain the boat building yard, where the 12 boats are under construction is overflooded. The work for that reason has been slowed down.

PHILIPPINES

Japanese-Built Floating Fish Canneries:

The Philippine's Reparations Commission announced on 18 February 1960. that the Japanese–built floating fish canneries and their complement of six fishing boats had been reawarded in separate lots to three different corporations. The boats originally had been awarded to the Estancia (Iloilo) Farmers Cooperative Marketing Association which had not used the boats and had no plans to use them. A packing corporation was awarded the following items: (1) a cannery costing P404,000 ($202,000), which will be stripped off one of the vessels; (2) three fishing boats with a total cost of P860,175 ($430,087); and (3) the P114,000 ($57,000) can manufacturing plant. The vessel which is to be stripped of its cannery equipment was awarded to a shipping company for P1,747,622 ($872,066). A fishery enterprise was awarded the following items: (1) one floating cannery for P2,151,622 ($1,073, 603); and (2) three fishing boats with a total of P860,174 ($430,087).

Shrimp Fishery:

According to the most recent statistics available on the landings of shrimp in the Philippines, the catch amounted to about 5.5 million pounds in 1957 and about 8.2 million pounds in 1956. In addition, considerable quantities of shrimp are caught by fishermen engaged in subsistence or personal use fishing which are not included in the statistics. Practicaly all of the shrimp caught and landed in the Philippines is consumed within the country. In 1957 the Philippines exported only about 19,000 pounds, valued at US$2,845, and in 1956 obout 7,000 pounds, valued at $1,254. In the Philippines no vessels are known to be engaged exclusively in shrimp fishing, but shrimp are taken along with other fish and shellfish. Most of the catch is sold fresh with the balance usually preserved with salt. (*Comm. Fish. Rev.*, April 1960).

Import Classification Changed for Squid (Cuttlefish):

In an April release by the Central Bank of the Philippines, squid (Cuttlefish) was one of the commodities which was classified as a nonessential consumer item. Previously, squid was classified item.

As a result, imports of this product into the Philippines will be adversely affected. As a decontrolled item, importers were able to secure dollar exchange without difficulty at a fixed rate of 2.5 pesos per US$1. As a nonessential consumer item, the importer will have to pay the "free market,' rate of 4.0 pesos per US$1 for dollar exchange, and the amount available will be limited. Thus, not only has the cost of dollar exchange needed to import squid increased 60 percent, but also the quantity available is limited.

This change in classification may have a strong bearing on United States exports of canned squid. In the first quarter of 1960, United States exports to the Pilippines were 3,924,000 pounds and represented 86 percent of the total United States trade in that product. In 1959, total United States exports of squid to the Philippines were 6,139,000 pounds. (*Manila Bulletin*, 28 April 1960).

SOUTH PACIFIC COMMISSION

COOK ISLANDS

Trap Fishing Investigations:

Encouraging results from an experiment in trap fishing are reported from the Cook Islands. The traps, simply made from wire netting covering a frams of steel rods welded together, are of a type successfully use by trap fishermen in Hawaii. The experimental traps measure 6 ft. × 4 ft. × 3 ft. 6 in., which is the maximum size that is practicable to handle from the 18-foot motor boat used. They each weigh 220 pounds, and are lifted by a small seaplane winch and $\frac{1}{4}$ in. stainless steel cable, fitted with a grapnel. During the six-month period of the experiment, almost every variety of common reef fish was caught. Large Moray eels up to 68 pounds were often taken, as were crayfish, both being in brisk demand on the local market. As a result of the investigations trap fishing has definite commercial possibilities in Rarotonga. (*South Pacific Bulletin*, July 1960).

NEW HEBRIDES

Green snail and *Trochus* shell fishing has long been a source of substantail income for many coastal villages in the New Hebrides. The conditions under which this activity has been carried out during the last fifty years, and more particularly the complete lack of protection (such as a minimum size and close season for the shells would have provided) have, as might be expected, resulted in these two shells becoming scarce. Moreover, due to high prices between 1954 and 1957, fishing became more intensive and the problem noticeably more acute. The production of *Trochus* shell, which had risen from 51 tons in 1950 to 122 in 1955, reached only 73 tons in 1957, although prices reached and even exceeded £A300 a ton that year. To avoid complete depopulation of the reefs, which are comparatively limited in area, the only solution was to close fishing completely. This was done in February 1958. The same decision was taken in respect of green snail, which had followed the same trend.

Small quantities of *Trochus* and green snail are in fact still collected in coastal areas purely for subsistence purposes, but there has been no sale of shells since the first quarter of 1958. A survey of the main reefs carried out in July 1959 has shown the need for continuing the ban on *Trochus* and green snail fishing. (The price of *Trochus* shell having fallen at about the same time, this decision was further justified on economic grounds. In the last few years, however, the most outstanding developments in the New Hebridean economy have been in the field of fisheries. Following the establishment of a Japanese fishing Company in Espiritu Santo, frozen tuna is now an important item among the exports of the Group. This firm also cures part of the catches on the spot and exports to Japan several qualities of katsuobushi (smoked and dried fish). The Company also makes cooked and dried fish flakes of very good quality, for sale on the local market. (*South Pacific Bulletin*, July 1960).

SINGAPORE

Manpower:

The number of fishermen operating under licences in the industry declined from 5,443 in 1957 to 5,368 in 1958. The decrease was due mainly to a decrease in the number of Chinese and Japanese fishermen. This was partly offset by an increase of 33 Malay fishermen.

Licensed Fishing Boats

The total number of licensed fishing boats increased from 2,756 in 1957 to 2,839 in 1958. There was a decrease in the number of non-powered vessels but this was offset by a significant increase in the number of outboard fishing boats which increased from 488 in 1957 to 620 in 1958. The total tonnage of the vessels increased from 3,418 tons in 1957 to 3,584 tons in 1958.

Licensed Fishing Gears

The total number of fishing gears licensed increased from 1,924 in 1957 to 2,009 in 1958. The increase was due mainly to inshore long-lines and gillnets.

Pond Cultivation of fish

Fresh water fish ponds in Singapore were used mainly for the cultivation in

Chinese carp fry from China. Imports of carp fry decreased from 2,016,760 in 1957 to 1,391,220 in 1958. The cultivation of *Tilapia* increased and this fish was sold at fish retail centres in the rural area as well as in certain city areas. Brackish water ponds were used mainly for the cultivation and trapping of prawns. Some were used for the cultivation of *Tilapia*. The acreage of these ponds was about 1900 and their estimated production 420 tons. The brackish water prawn ponds at the Fisheries Experimental Station at West Coast Road continued to give a high yield of prawns. Since their construction towards the end of 1954, these ponds, which cover an area of about 14 acres, have yield a total of 32,191 katties of prawns, fish and crabs, valued at about $35,963 on the auction markets. The cost of building the bunds, sluice gates and huts amounting to about $12,840 was fully recovered in less than two years. The average monthly gross income for these two ponds for the last two years amounted to a little over $750. In order to ascertain if this income could be increased, pig rearing was carried out with the co-operation of the Veterinary Division which supplied five pigs of mixed breed, being crosses between Berkshire Boars and local sows, whose initial weights varied from 22 lbs. to 98 lbs. They were reared on rations supplied by the Veterinary Division and reached marketable weight after periods varying from 10 weeks in the case of the pig weighing 98 lbs. to 22 weeks in the case of the pig weighing 22 lbs. The increase in weight varied from 5.6 lbs. per week to 10.6 lbs. per week. Prawn pond operators and farmers, who visited the experimental ponds to witness the progress of the project, were impressed by their rapid growth rate.

Gross Landings

The fresh fish supplies of Singapore consisted of (i) imports from neighbouring territories such as the Federation of Malaya, Indonesia, Thailand and China and (ii) production of Singapore licensed fishing gears. The total volume of fish landed in Singapore amounted to 37,754 tons in 1958. Only 1,845 tons were exported.

Local Production

The estimated production of the major fishing units of Singapore deceased from 13,593 tons in 1957 to 12,146 tons in 1958. However, it still showed an increase from the 1956 production which was 9,431 tons. The drop in production for 1958 was partly due to a fall in the catches of kelongs and drift-nets. The fall in production by inshore units is, however, partly offset by and increse in production by the trawlers. The 8 trawlers landed a total of 2,224 tons in 1958. This is significant as this represents more than 18 percent of the total production of major gears of Singapore.

Imports and Exports of Fresh Fish

Imports of fresh fish increased from 25,577 tons in 1957 to 25,607 tons in 1958. There was a decrease in imports from China, Hong Kong and Japan but this was offset by an increase from Indonesia, Federation of Malaya and Vietnam. Imports from China decrease from 3,523 tons in 1857 to 2,468 tons but this was not due to a fall in the demand of consumers for the imported fish. The consumer's demand for fresh fish imported from China was favourable as they were much cheaper than fish imported from Indonesia. The fall in imports was mainly due to difficulties in obtaining supplies

from China. There was a slight decrease in the volume of fresh fish exported.

Market Handlings

The volume of fresh fish handled in the auction markets increased slightly.

Prices of Fresh Fish

There was a significant decrease in the annual average retail prices of many types of fresh fish, in spite of a decrease in the gross landings. In most cases, the decrease was more than 10 percent. This was mainly due to the increased landings of the more popular species of fresh fish judging from the increased handlings of fresh fish in the auction markets and from increased imports from the Federation of Malaya, Indonesia and Vietnam. The increased imports of fresh Kurau from Vietnam has brought its retail price down by 6½ per cent from that of 1957.

Trade in Dried Salt Fish and other Marine Products

The volume of imports and exports of dried salt fish in 1958 was slightly lower than that in 1957.

Cost of Fishing Materials

In 1958, prices of most items of fishing materials showed at slight decrease though there was an appreciable increase in the price of coir rope. (*Report of the Fisheries Division* for 1958)

TAIWAN

Fisheries Landings in 1959

The 1959 fishery landings in Taiwan reached 246,327 metric tons, an increase of 7.25 percent over 1958 landings of 229,677 tons. The catch by categories as compared with 1958 shown in the table. Over 70 percent of the 1959 production was contributed by the deep-sea and inshore fisheries and the remaining 30 percent by coastal fisheries and fish culture. This is contrast to the production of 1952 in which the deep-sea and inshore fisheries accounted for only 40 percent of the total catch. The drop in landings from the coastal fisheries is attributed to the motorization of many sampans which place them in the inshore fisheries. Fish-culture production in 1959 was set back by the serious flood in August. The 1959 fishery catch exceeded the planned goal of 242,000 tons. The new goal set for fisheries production in 1960 is 255,000 tons.

Tuna Fishing

Encouraged by the successful operation of the four 350-ton tuna longliners built in 1957, the fishing industry is planning the construction of two 550-ton tuna boats in 1960. Export of frozen tuna to the United States amounted to 688 tons in 1959 as compared to 146 tons in 1958.

Chemical Fertilizers in Milkfish Ponds

With the successful demonstration of the application of chemical fertilizers in milkfish ponds conducted by the Taiwan Fisheries Research Institute, the fish-pond operators in Taiwan have applied to the

local Fertilizer Distribution Administration for a total of 1,505 tons of ammonium sulphate and 587 tons of superphosphate. The use of chemical fertilizers has proved to be more economical and sanitary than the use of natural fertilizers such as rice bran, soybean meal, or night soil. (*Comm. Fish. Rev.*, May 1960).

THAILAND

Shrimp Industry

The shrimp fishing industry in Thailand consists of many small enterprises scattered along the coast and also inland for fresh-water shrimp. Most of the catch, which is estimated to have averaged about 10,370 metric tons annually for 1956-58, is consumed in Thailand. Small quantities of both fresh, frozen, or dried shrimp are exported (exports varied between 10 tons in 1959 to about 40 tons in 1958 for all types). In 1958, export of frozen shrimp (less than 200 pounds) to the United States was started on an experimental basis. In 1959, according to estimates, frozen shrimp exports to the United States from the Port of Bangkok rose to 23.9 tons valued at about US$29,868. Late in 1959 there were three companies exporting shrimp from the Bangkok area. All three firms used the cold-storage facilities of the semi-Government-owned and operated Cold Storage Organization in Bangkok. Only one of the firms (Japanese) handling and processing shrimp for export has specialized equipment of shrimp fishing. Most of the shrimp catch is made during the dry season, although shrimp stocks are believed to be available throughout the year. The catch is confined largely to coastal waters, especially in the southern part of Thailand where the largest quantities are caught. In 1957, powered vessels 5 net tons and under totaled 482 and vessels over 5 net tons amounted to 273 for a total tonnage of 5,688. Mechanized fishing vessels increased sharply in number and tonnage in 1958 consisted to 647 vessels of 5 net tons and under and 943 vessels over 5 net tons for a total tonnage of 18,318. In addition, in 1958 there were 601 vessels without power averaging about 6 tons in size. No vessels are used exclusively for shrimp fishing, and a fair portion of the annual shrimp catch is taken by stationary fishing gear, such as bag nets. The Thai Department of Fisheries has a program to provide loans at low interest rates for fishermen to purchase fishing gear and motors. Most of the fishing enterprises are family undertakings, and more and more of the vessels are being mechanized.

Prices paid for shrimp at the auction held by the Fish Marketing Organization in Bangkok from January-September 1959 averaged 42.5 U.S. cents a pound for large shrimp and 24.7 U.S. cents a pound for small shrimp. The price range for large shrimp was from 38.9 to 48.7 (January) and from 21.6 to 28.1 (July) U.S. cents a pound for small shrimp. Costs of processing shrimp for export based on purchase prices ranging between 30 and 48 U.S. cents a pound are as follows: processing, US$5.71 a ton; cold-storage, first month $39 a ton; transportation to harbor, $23.80 a ton. Total costs to point of shipment ranged from 33.6 to 50.8 U.S. cents a pound. (*Comm. Fish. Rev.*, April 1960).

NORTH BORNEO

Tuna Fishing

A Japanese company has decided to establish a joint tuna fishing company in British North Borneo with its base on a small island 60 miles east of Tawan. In February 1960 the Japanese company's freezership GUIVE MARU (3,800 tons) was expected to sail for Borneo. In the beginning, five skipjack boats will be used to catch an estimated 8,000 tons a year. The cannery, which will be set-up in conjunction with the fishing operation, is expected to pack 100,000 cases the first year. The capital of the new company will be some $638,889. (*Fisheries Economic News*, 30 January 1960).

HONG KONG

Shrimp Industry

Shrimp landings in Hong Kong in 1958, according to data furnished by the Fish Marketing Organization of the Cooperative Development Department of the Hong Kong Government, amounted to about 6.2 million pounds valued at US$1.5 million wholesale. Landings for the first six months of 1959 of 785,000 pounds (valued at $207,000) were down sharply from the 3.5 million pounds (valued at $668,000) landed in the same period of 1958.

Cost of Production for Export: No detailed information on cost of production for export is available. As of June 1959, frozen headless and deveined shrimp for export was valued at 51.5 U.S. cents a pound to point of shipment or f.o.b.

Exports: Shrimp exports prior to January 1, 1959, were included with other fresh and frozen shellfish (crustacenas and mollusks). During 1958 a total of 6.6 million pounds (value US$3.8 million) of fresh and frozen shellfish were exported. For the first nine months of 1959, exports of fresh and frozen shrimp (exclusive of other shellfish) were only 774,000 pounds, valued at $515,000. The United States was Hong Kong's principal customer for fresh and frozen shellfish in 1958-shipments to the United States were about 4.1 million pounds, valued at $2.8 million, or about 63.1 percent of the quantity and 74.0 percent of the value of fresh and frozen shellfish exports. In addition to exports of frozen shrimp to the United States, some quantities of dried, salted, or pickled shrimp were shipped.

The U.S. Treasure Department in mid-1959 prohibited shrimp imports from Hong Kong because shrimp produce in Communist China was coming into the United States through Hong Kong. Thus exports of shrimp to the United States from Hong Kong ceased in June 1959.

Export Controls and Taxes: As of 1959 there were no export controls or taxes on shrimp. (*Comm. Fish. Rev.*, May 1960).

The Quarterly Report of the co-operative Development and Fisheries Department For April to June, 1960 gives the following information:

General

With the winter drought extending into April, followed by heavy rains and widespread flooding in May and one of

the most disastrous typhoons for many years in June, fishermen were particularly hard hit by typhoon "Mary" which passed through the Colony in the early hours of the morning of 9th June. 155 fishing vessels were sunk of damaged beyond repair and 37 fisherfolk lost their lives.

Co-operative Societies

Eleven new societies were registered during the quarter, including a Federation, to bring the total number of societies in the Colony to 275. The Federation embraces five fishermen's societies in the Sai Kung area; the other new registrations were six Building Societies, two fishermen's Thrift and Loan Societies, a Pig Raising Society and a better Living Society. The Fishermen's Society at Kat O has amended its by-laws to allow the Society to under-take a housing scheme. The District Office at Tai Po has approved the site selected and has provided some of the materials required to form the site.

Credit Facilities

The disasters that beset the fishing and farming communities during the quarter provoked heavy withdrawals from the loan funds administered by the Department to underline again the necessity and value of these funds. The total loaned from the J.E. Joseph Fund considerably exceeded that for any previous quarter. During the quarter loans totalling $ 379,620 were made from the Fish Marketing Organization Fund to 80 members of co-operative societies; further loans totalling $154,810 were made to 70 individual fishermen to bring the total sum disbursed from the Fund during the quarter to $ 534,430. 66 of these loans totalling $ 173,670 were made in the period immediately following typhoon "Mary". From the C.A.R.E. Loans Fund, 7 loans totalling $ 6,850 were made to shrimp fishermen. Repayments to the Organization Loan Fund during the quarter amounted to $ 317,262 and to the C.A.R.E. Fund $ 1,136.

Fish Marketing Organization

The Dragon Boat Festival celebrated in May distracted fishermen for a brief period, but landings continued at a high level through the quarter until the arrival of typhoon "Mary" with the effect described elsewhere in this report. Following on the heels of typhoon "Mary", a second typhoon threatened the Colony but, fortunately, did not materialise. However, fishermen were understandably wary and this factor, coupled with the damage that many had suffered earlier, resulted in fairly low landings during the last three weeks of the period under review. Some 175,266 piculs of fresh marine fish passed through the Organization's wholesale markets during the quarter representing a decrease of 16 % when compared with the total quantity marketed during the preceding quarter. Of this total 155,740 piculs were landed by local fishing vessels, 3,975 piculs were landed by foreign fishing vessels and 15,551 piculs were imported from China. However, the average wholesale price at $ 70 per picul was only 1.5% higher than the average wholesale price for the preceding quarter. There was a further decrease in the quantity of salt dried fish marketed, and sales through the Organization's wholesale markets totalled 10,727 piculs; a drop of 12.6% when compared with the quantity marketed during the preceding quarter. The average wholesale price was $ 33 per picul compared with $ 28 per picul for the previous quarter.

Education

At the close of the period under review 2,164 fishermen's children were receiving education with the aid of the Fish Marketing Oganization. Of this number 1,308 are attending Fish Marketing Organization schools and 836 hold Fish Marketing Organization scholarships to other schools. New fishermen's children's schools are proposed for Tai Po and Sai Kung and sites have been selected. The site at Sai Kung has been approved and plans of the school building are now being prepared. The teachers' quarters at the Organization's school at Hang Hau were completed at the end of May. An adult education class is being run for fishermen at Shau Kei Wan. It is proving popular and consideration is being given to opening similar classes at Sha Tau Kok, Tai Po and Tai O.

Miscellaneous

In the course of typhoon "Mary", two Japanese-type trawlers belonging to a local company were sunk at the sea wall at Aberdeen Market. A pillar and one of the landing jibs at the market were demolished and the sea will the buildings at the western end of the market suffered extensive damage. At Shau Kei Wan the market was flooded and the auction floor roof severely hold by falling debris. Immediately following the typhoon, some 2,250 fishermen and boat people sought shelter in the Aberdeen Market. Emergency feeding arrangements were made with the Social Welfare Department who acted with commendable alacrity. Many boat-people were still receiving emergency rations from the Social Welfare Department at the Market at the close of the quarter. The Department was asked to administer grants to fishermen from the Community Typhoon Relief Fund which was set up immediately following the typhoon from generous donations by members of the public. Rehabilitation grants were made from the Fund to those fishermen whose fishing vessels had been either sunk or damaged beyond repair and the staff of the Department and the liaison staff beyond repair and the staff of the Department and the liaison staff of the Fish Marketing Organization concluded payments to fishermen within 14 days, awarding 130 grants totalling $193,943 from the Fund. A number fishing whilst many others have purchased second hand vessels. The generosity of the people of Hong Kong in donating to the Relief Fund was much appreciated by the fisherfolk of the Colony in their hour of need. Through this difficult and trying period, various relief organizations stepped up their activities and rendered invaluable assistance. The Fish Marketing Organization undertook on their behalf the distribution of relief to distressed fishermen and boat-people throughout the Colony and in the period immediately following the typhoon distributed 12,499 food parcels, 117 fishermen's kits, 1,263 blankets and 743 sets of cooking utensils donated by C.A.R.E.; 8,930 tins of pork and 32 bales of used clothing from the Mennonite Central Committee; 29,696 lbs. of rice from the Church World Service; 431 tins of pork from the British Red Cross; 2,500 lbs. of dry noodles from the Po Leung Kuk and 198 blankets donate by the Aberdeen Kai Fong Welfare Association.

UNITED STATES OF AMERICA

The News Notes on Scientific Activities of the Honolulu Biological Laboratory, July and August 1960 gives the following information:—

The Bureau of Commercial Fisheries has recently initiated an intensive study of Pacific tuna species with reference to the hereditary composition of tuna stocks. Geneticists in the recently implemented program at the Honolulu Biological Laboratory report a major advance in the study of skipjack populations with the development of battery of serological test fluids which will detect complex patterns of individual differences between the red blood cells of different skipjack. These antigenic differences analogous to those found in man (A-B-O, etc.) and other vertebrates are the products of the units of inheritance, genes. Honolulu Biological Laboratory scientists report that a study of the frequency with which the various characters occur in tuna populations will lead to a genetic definition of tuna stocks. Such a definition may allow a more sophisicated study to be made of growth, recruitment, and mortality rates which may be unique for different racial or genetic stocks within the same species. The antigenic characters themselves which are in a sense analogous to "natural" tags on the population level may also yield important information regarding the geographic distribution and migration of the tunas. Preliminary methodological studies have been carried out by the Honolulu Biological Laboratory and visiting university scientists on a small scale since 1955 and more recently with the La Jolla Biological Laboratory, Bureau of Commercial Fisheries.

Over 13,000 skipjack tuna have been tagged in Hawaiian waters with the D-2 dart tag. Although the recoveries, totalling nearly 1,300, have indicated considerable movement among the islands, there are no records of recapture of these tagged fish in any other fishery. The Hawaiian skipjack fishery is seasonal; the bulk of the annual catch is made between May and September. Although it is hypothesized that these fish enter the Hawaiian area in the spring and leave in the fall, the lack of returns from other areas of skipjack tagged in Hawaiian waters, the lack of positive evidence that fish recovered one or more seasons after tagging have actually been away during the interim and the lack of recoveries in Hawaiian waters of skipjack tagged elsewhere in the Pacific have resulted in increased efforts by HBL scientists to tag skipjack wherever they may by encountered outside of Hawaiian waters in an effort to answer "where do they come from?" where do they go?" In April 1960, 46 skipjack were caught, tagged and released from the CHARLES H. GILBERT near Roca Partida of the Revillagigedo Islands group, incidentally to other studies. Although the results of this limited tagging effort has failed to provide any answer to the above questions, it is interesting to note that eleven of the tagged tuna (24%) have been recaptured within two months after release and all but one from within the area of release. One fish was recovered about 180 miles north of the release area. All recoveries were returned through the courtesy of the Inter-American Tropical Tuna Commission.

The comparatively high percentage of recovery of these tagged skipjack may reflect the existence of a resident population associated with a group of islands or their movement may have been temporarily restricted by certain environmental factors. In May 1958, 2,000 skipjack were tagged and released in an area off Hilo, Hawaii. A total of 431 of these tagged fish, or 21.5% were recaptured within 3 months, with all but 2 from the same general area of release. These fish may have been "trapped" in a patch of low salinity water surrounded by water of higher salinity and, presumably, also differing in other characteristics. Later returns showed that at least some of the skipjack tagged off Hilo regrouped with other schools and moved north-westerly along the Hawaiian archipelago. Tag returns from individual schools suggest that,normally the skipjack in Hawaiian waters remain within a school for one month or less, then at least some of the school break off, move into new areas and regroup with other fish or schools. From the releases off Hilo and Mexico, however, it is evident that there are situations, possibly environmentally conditioned, where the schools remain intact and within a restricted area for a least 2 or 3 months and thus are readily available to capture by fishermen.

Albacore Spawning Ground Search

The M/V CHARLES H. GILBERT fishery research vessel of the Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, returned to Honolulu last week from an extensive 70-day cruise to the west of the Hawaiian Islands. The objective of the cruise was to learn if the North Pacific albacore spawning ground is located in this area at this season. A cooperating Japanese agency, the Nankai Regional Fisheries Research Laboratory at Kochi, conducted a similar survey with the research vessel SHUNYO MARU in the western Pacific in coordination with the work of the GILBERT. The GILBERT fished the survey area with longline fishing gear in an attempt to capture sexually mature albacore. In addition to longlining, the GILBERT conducted night light fishing stations and midwater trawling operations to capture young tunas. Biologists returning aboard the GILBERT reported that the survey area yielded poor catches of adult albacore. The survey area was not expected to yield commercial quantities of albacore, the scientists being primarily interested in obtaining data on the sexual maturity and fecundity of the albacore from the area. While there were but a few large albacore taken, the net collections yielded considerable number of larval tuna. Although the collections have not yet been studied, some of these may be larval albacore. If so, this will provide evidence regarding the spawning area and season of this species he stated, During the cruise, the GILBERT called at Kwajalein, Wake, Midway, and Laysan islands and prospected their waters for tuna baitfish.

VIETNAM

Chanos Culture

The pond rearing of milkfish (*Chanos*), which was started in Viet-Nam late in 1958 on a commercial scale, is developing rapidly in Central and South Viet-Nam. During 1959 two rearing stations were developed by the Fisheries Directorate and over 100,000 milkfish fry were captured for rearing purposes. In 8 months, 10,000 fry will yield about

6 metric tons of prime marketable fish. A number of privately-owned commercial rearing ponds have now been built and other are under construction this year. All are designed similar to those built by the Inland Fisheries Culture Service. As surveys reveal additional areas of fry concentration in coastal brackish waters, up to a million milkfish fry may be captured by 1962. In Taiwan, where the rearing of milkfish has been conducted for the past 30 years, it is the most important pond fish and is one of the leading food fishes. The magnitude of the Taiwan milkfish industry may be judged by noting that between 90 and 100 million fry are captured annually for pond-rearing purposes with 118 million being the record catch. The pond-rearing area exceeds 13,000 hectares. Pilot rearing stations established during 1959 indicate that the vast mangrove swamp area of coastal Viet-Nam is admirably suited for milkfish rearing. The limiting facors will be the ability of the Fisheries Directorate to discover sufficient milkfish spawning areas and the development of techniques for catching them in volume. (*Comm. Fish. Rev.*, May 1960).

New Trawlers

The Vietnam fishing company located in Saigon received two new 74-ton fishing trawlers during February 1960. Both were purchased from Japan under the commercial import program at a cost of two million piasters (about US $ 51,143 at exchange rate of 35 piasters to US $1) each. Both vessels are equipped with cold-storage facilities, radar, and two-way radio to facilitate deep-sea operations out of the Port of Saigon. They were due to begin operatiions off the coast of Vietnam late in February with 14-man crews aboard each vessels. The owner and manager of the fishing company states that he expects each vessel should bring in 25-40 metric tons of fish each trip. The Saigon fishing company operating the trawlers is the third large fishing company to be formed in Saigon. The other two are companies which have two vessels each and are averaging monthly catches of about 100-120 tons. It is reported that the fishing company in cooperation with a Japanese engineer, is studying plans towards the establishment in 1961 of a dried fish and fish meal plant. (*Comm. Fish. Rev.*, June 1960).

Shrimp Industry

The average annual catch of shrimp for 1956-1959 to estimated by the Viet-Nam Directorate of Fisheries at 5,000 metric tons. There are no data concerning the species and value of shrimp taken. At the January 1960 average ex-vessel price of 27.5 piasters per kilogram, an annual catch of 5,000 metric tons would be worth 137,500,000 piasters, or US $ 3,928,571 at the official rate of exchange of 35 piasters per U.S. dollar. The Directorate of Fisheries estimates that there are more than 2,000 boats engaged in fishing for shrimp at one time or another during the year. The boats vary in size, but are mostly very small craft powered by sail and oars. A few fishing boats now have gasoline engines. There are presently no construction programs for shrimp fishing vessels. A new Vietnamese firm organized to catch, freeze, and export shrimp, plans to have five Japanese-built vessels, or 75 to 150 tons, with Diesel power, by the end of 1960. This firm is only now begining commercial

operations. Initial production is expected to be about 600,000 pounds a month. Exports, at least at first, will be made only to the United States. According to reports, the first shipment of frozen shrimp to the United States will be made early in 1960. Ex-vessel prices for shrimp in Saigon in January 1960 were 30-35 piasters per kilogram (about 38.9-45.4 U.S. cents a pound at official rate of exchange) for large shrimp and 20-25 piasters per kilogram (25.9-32.4 U.S.cents a pound) for small shrimp. Shrimp are sold only by size, never according to species. Since 1956 small quantitites of dried shrimp have been exported from Viet-Nam. The current market price for dried shrimp exported to Hong Kong and Singapore is 24.14 piasters per kilogram or about 31.3 U.S. cents a pound. Exports of dried shrimp from 1956-59 averaged about 37.5 metric tons per year with about 67.7 percent exported to Hong Kong, 26.7 percent to Singapore, and about 10.7 percent to other destinations. There are no current export controls (except as part of general licensing of all exports) or taxes on exports of fresh shrimp. Dried shrimp must pay an export tax of 5 percent ad valorem. Earnings of foreign exchange from exports of shrimp must, as is true of all exports, be exchanged for piasters, 65 percent at the official rate of 35 piasters per dollar, and 35 percent at the free rate of approximately 72 piasters per dollar. The relatively small annual shrimp landings made from Vietnamese waters are not an indication of the available supply. Most shrimp are now caught in shallow coastal waters, bays, and rivers mouths. Deep-water fishing grounds for shrimp have been located at several places off the coast, and it appears that there is a plentiful supply of two or three large species.

Export of Frozen Shrimp

On 24 January 1960, a new Vietnamese shrimp fishing and processing company made its first shipment of quick-frozen shrimp to the United States. The shipment of ten metric tons, packed 5-pounds to the carton, was expected to bring about 70 U.S. cents a pound in New York. Less freight charges, the shipment should net the new firm about US$13,628. For the near future, the company hopes to ship about 30 tons a month. The company's freezing capacity is 60 tons a months, but it is still plagued with difficulties in securing adequate supplies of raw shrimp. At 30 tons a month, foreign exchange earnings for Viet-Nam would approach US$500,000 a year. The company's present intention is to sell the entire production in the United States. The company is now actively seeking two special shrimp trawlers from Florida or Japan to improve raw shrimp landings. It has also recently sent a sample shipment to New York of special shrimp, found near Soo-Trang on the southern mouth of the Mekong. These shrimp, believed to be unique, have tails 6-8 inches in length. The New York importer's response to the sample was said to be enthusiastic. As an added inducement, the heads (carapaces) are said to be marketable locally for soups. (*Comm. Fish. Rev.*, April 1960).

Fish Culture

A statement made at the 8th ICA Far East Food & Agriculture Officers' Conference, March 1960 in Saigon indicated that in connection with the Land Development Program, a Pisciculture Station is to be established in 1960 and starting with 1961, fingerlings of various freshwater fish species will be distributed to the Land Development Centers to augment protein intake of the settlers.

FAO ACTIVITIES

Appointments

Mr. Michel Girard, who has been with the Organization since 1949 in the capacity of Regional Fisheries Officer, Europe and Near East, has now been assigned on an indefinite basis as Fisheries Officer, U.N. Special Fund projects at headquarters. Mr. Girard will start his assignment on 1 October 1960. Mr. H. Rambaud will be in charge of the Regional Fisheries Office, Europe and Near East, in an acting capacity.

Mr. Jean Louis Gaudet has been appointed as Fisheries Economist in the Economics and Management Section of the Economics Branch, the permanent post vacated by Mr. Kaare Ruud in September of last year. Mr. Gaudet is a Master of Arts in Economics from the bilingual University of Ottawa and has also a degree of Master in Public Administration, obtained from the Maxwell School of Citizenship and Public Affairs, of Syracuse University, New York. Before taking up his appointment with FAO, Mr. Gaudet was employed as Economist-Statistician by the Federal Department of Fisheries in Newfoundland, Canada. Mr. Gaudet is a Canadian national and bilingual in English and French.

Technical Assistance

Mr. G.S. Illugason (Iceland) arrived from home leave in Rome on 7 August 1960 and remained at Headquarters for about ten days for technical discussions and report writing prior to resuming his assignment as FAO/TA Master fisherman in Ceylon. Mr. Illugason has completed a six-year assignment in India as FAO/TA Master fisherman, and has been transfered to Ceylon where he will undertake a similar assignment for at least on year.

Dr. S.A. Beatty (Canada) arrived in Rome in 12 September 1960 having terminated his assignment in Cochin, India, as FAO/TA Fish Processing Expert. Dr. Beatty remained as Headquarters for approximately one week for the purpose of technical discussions, completion of final report and administrative separation.

Fellowships

Mr. Bu Kwan Chung, Republic of Korea who was awarded an FAO/ETAP Fellowship to study the Survey of Living Resources in the Sea completed his fellowship during September 1960. He spent about one year in Canada and then visited the Pacific Oceanic Fisheries Investigations in Hawaii. He also visited the Tokyo University of Fisheries and the Tokai Regional Fisheries Research Laboratory, Tokyo.

Mr. Chee Choul Keun, Chairman, Fisheries Committee, FAO Korean Association, and formerly Director, Bureau of Fisheries, Republic of Korea, has been awarded an FAO/ETAP Fellowship for studies in the field of fishery treaty and conservation of sea resources. He will visit U.S.A. (6 months), Canada (1 month), Iceland (1 week), Norway (2 weeks), Denmark (2 weeks), Germany (2 weeks) and U.K. (1 month).

Mr. A.B.O. Merican, Fisheries Research Officer, Department of Fisheries, Federation of Malaya, has been awarded FAO/ETAP Fellowship for a period of 8 months for studies in the field of inland fisheries in India, Thailand, Japan, Hong Kong and Indonesia. Mr. Merican will study in India for 3½ months and will study at the Inland Fisheries Research Station, Cuttack, Orissa and also at Calcutta. In Thailand, he will stay for

about 2 weeks and in Japan about 6 weeks. He will study in Hong Kong for 3 weeks and will study various practices on fish culture, in particular culture of Chinese carp and mullet. In Indonesia, he will spend 6 weeks and will familiarise himself with freshwater and brackish fisheries.

Miss Bung-Orn Kasemsarn who was awarded an FAO/ETAP Fellowship to study fish processing and quality control last year completed her fellowship during August 1960. She spent several months in U.K. and Canada. She is continuing her studies privately in U.S.A.

Early in September 1960 Mrs. Priscilla C. Borja returned to Manila after 5 months in U.K. and Germany studying Morine Biology. Mrs. Borja was working under an FAO/ETAP Fellowship and the results to her studies will be applied in Marine Biological and Fisheries Research with the Philippine Bureau of Fisheries.

Documents issued

Catalogue of FAO Fisheries Publications–August 1960.

Current Bibliography for Aquatic Sciences and Fisheries, Vol. 3(1) and (2). Published for FAO by Taylor and Francis Ltd., London. These are the first printed issues received.

Report of the Latin American Inland Fisheries Training Center conducted by the Government of Colombia and the FAO at Buga, Colombia, 1 February-12 March 1960, by John Greenbank.

Manual of Field Methods in Fisheries Biology, *FAO Manuals in Fisheries Science No. 1*, edited by G.L. Kesteven.

Fisheries Resources of the East Coast of Africa and the Central Indian Ocean, by H. Rosa, Jr., and T. Laevastu.

European Inland Fisheries Advisory Commission–Report on First Session, Dublin, 25-30 April 1960.

Proceedings of the Joint Scientific Meeting of ICNAF, ICES, and FAO on Fishing Effort, the Effect of Fishing on Resources and the Selectivity of Fishing Gear, Vol. I–Reports.

Catalogue of the Names of Fishes of Commercial Importance in the Mediterranean (GFCM).

Methods of Treating the Bottom of Fish Ponds and their Effects on Productivity–Fish Culture in Certain European Countries. *GFCM Studies and Reviews*, No. 11.

Mediterranean Brackish Water Lagoons and their Exploitation. *GFCM Studies and Reviews*, No. 12.

Financial Assistance Schemes for the Acquisition or Improvement of Fishing Craft. *Fisheries Study* No. 9, English, French, and Spanish.

Economic Role of Middlemen and Cooperatives in Indo-Pacific Fisheries.

FAO Yearbook of Fishery Statistics, Vol. X (Trade).

The Need for Economic Statistics of the Fisheries, by Anthony Scott. *Fisheries Paper* No. 16.

The Use of Fishery Statistics by Government and Business in Northwest Europe, by G.M. Gerhardsen. *Fisheries Paper* No. 17.

The Use of Fishery Statistics by Government and Business in North America, by John B. Rutherford. *Fisheries Paper* No. 18.

IPFC AFFAIRS

Personnel: Mr J.A. Tubb, Secretary, IPFC visited Malaya, Singapore, Brunei and also attended the FAO Far East Regional Conference held at Saigon, Vietnam during 20-30 November 1960.

Dr. G.N. Subba Rao, Technical Secretary, Technical Committee II, visited the Republics of Vietnam and Philippines during August-September where he inspected various fisheries research, marketing, and processing, establishments in these countries and also collected information for the Report on Boiled Fish and the Fishery Products Manual.

Dr. Rao also visited Malaya and Singapore during November.

9th Session: The 9th Session of the Council is scheduled to be held during 6-23 January 1961 at Karachi, West Pakistan.

Circulars issued:

IPFC/Circ. 60/17	– to Member Governments (Eng. & Fr.)	– Invitation to IPFC 9th Session, Agenda, Draft Programme and Financial statements.
IPFC/Circ. 60/18	– to Observer Organizations	– ditto
IPFC/Circ.60/19	– to Non-Member Governments	– ditto
IPFC/Circ.60/20	– to Member Governments (Eng. & Fr.)	– Opening statements required for tabling.
IPFC/Circ. 60/21	– to Technical Committee I	– Requesting short report on present status of research and development.
IPFC/Circ. 60/22	– to Technical Committee I (Panel A)	– Requesting report on list of items.
IPFC/Circ. 60/23	– to Technical Committee I (Panel B)	– Requesting report on list of items.
IPFC/Circ. 60/24	– to Mackeral Sub-Committee	– Requesting report on present status of mackeral fisheries.
IPFC/Circ. 60/25	– to Chanos Sub-Committee	– Requesting report on present status of chanos fisheries.
IPFC/Circ. 60/26	– to Hilsa Sub-Committee	– Requesting report on present status of Hilsa fisheries.
IPFC/Circ. 60/27	– to Fish Culture in Rice Fields Sub-Committee	– Requesting report on present status of this subject.

IPFC/Circ. 60/28	to Technical Committee II and its Panels A & B	Requesting report on activities under purview of this Committee.
IPFC/Circ. 60/29 (Eng. & Fr.)	to Member Governments	Nominations to various Committees etc.
IPFC/Circ. 60/30 (Eng. & Fr.)	to Non-Member Governments	Opening statements required for tabling.
IPFC/Circ. 60/31	to Observer Organizations	ditto
IPFC/Circ. 60/32 (Eng. & Fr.)	to Member Governments	Amendment to the Agreement.
IPFC/Circ. 60/33	to Technical Committee II and its Panels A & B	Meetings of the Technical Committee II.

Fish Processing Training Center: The IPFC/FAO/ETAP Training Center on Fish Processing in Humid Tropics is tentatively scheduled to be held from 6 March for a period of six weeks.

PERSONALIA

Mr. A.G. Bollen has been appointed Assistant Director, Fisheries Division, Department of Primary Industry, Canberra. He succeeds Mr. C.G. Setter who was appointed Director of Fisheries on the retirement of Mr. F.F. Anderson.

Mr. Bollen's wide experience in economic investigation, in such fields as production, transports and processing, should be of benefit to the Australian fishing industry where there is much economic research work to be done; e.g. the expanding tuna industry.

CURRENT READING

Lobster Fishing in Ceylon, by G.H.P. de Bruin, Bulletin No. 9. Fisheries Research Station, Department of Fisheries, Colombo, Ceylon. This Bulletin gives an accounts of the experiments carried out in the Ceylon waters with different types of traps for catching lobsters. The contents are as follows: Introduction; lobster traps used in experiments; experimental operations on the East coast; experimental operations on the West coast; lobster grounds; catch per unit trap; development of a collapsible trap; summary.

There are ten illustrations which show the different types of lobster gear employed as well as lobster fishing grounds.

Standardization of Fish Names

The first attempt to standardize the names of fish in order to make fishery statistics comparable among Mediterranean countries has been undertaken, in

the form of an illustrated draft catalogue issued by FAO. The Catalogue, containing the names of fish of commercial importance in the Mediterranean, will be distributed to members of the General Fisheries Council for the Mediterranean (GFCM) when the council meets here from 22-28 September. Compiled by Dr. Giorgio Bini, an Italian biologist, and edited by the council's secretary, Michael Girard, Regional FAO Liaison Fisheries Officer for Europe and the Near East, the book contains sketches of 250 fish, with their chief characteristics, species, order and family. Wherever possible the fish's common name has been given in each of the languages of the 12 GFCM member nations.[1] The need for a catalogue became evident, when Mediterranean fisheries experts found they had difficulty in interpreting national statistics for publications, since the same fish was often designated under different names. Some fish were not named at all. This made the assessment of catches and their commercial value extremely difficult. The catalogue lists all fish of commercial importance in the Mediterranean—such as the sea horse—and not just fish that are edible. The sea horse is currently in vogue for use in costume jewelry. Fish such as herring, cod, haddock, coalfish and halibut, not caught in the Mediterranean but found in Mediterranean markets, are list separately in the catalogue. The catalogue is so bound that its pages may be removed and filed according to the language classification of each Mediterranean country.

Seamanship Illustrated

Mr. Charles Hulse of the Marine Department, Hong Kong, is to be congratulated on having undertaken an extremely difficult task and on performing it extremely well. "The Local Master's Handbook" published by Hong Kong University Press, Hong Kong, and which he has taken some 10 years to prepare, is based on the many years of practical experience under very varied condition, of the author who was born in 1920 in Aberdeen, Scotland, of a family with a long history of seafaring.

The volume, of some 600 pages, is bilingual, the text being presented in English and Chinese page for pages. It is abundantly and clearly illustrated with well over 200 pictures and line-drawings which include charts of the Hong Kong area.

The Handbook is divided into 3 sections as follows:

Book I: Rules of the Road
Book II: Ship Handling
Book III: Chart Navigation, Local Knowledge and Weather.

To this reviewer it seems that every possible point where an illustration either clarifying or emphasising the text would be useful, has been recognised and appropriate illustrations presented.

Book II dealing with Ship Handling gives practical advice to operators of all the smaller types of craft and there is a special section to the design, handling and operation of trawlers and seiners.

In the third book, useful examples of chart work and problems to be solved are presented after an extremely lucid description of the equipment and apparatus and of the use and interpretation of charts.

This is followed by a detailed section giving local Hong Kong Port information and advice relating to the basic navigation requirements and problems of that area. The book is terminated by

1. Member countries: France; Greece; Israel; Italy; Monaco; Morocco; Spain; Tunisia; Turkey; United Arab Republic; United Kingdom; Yugoslavia.

appendices giving syllabuses for local master's certificates modified for fishing vessels up to 1,000 picul (60 tons), for pleasure craft up to 7 tons and for vessels up to 60 tons.

It is obvious that the course of the study suggested in this list would be appropriate for almost all the countries in this region and the book itself will undoubtedly find wide use, particularly in those areas where mechanisation of the fishing fleet is proceeding and where largely more modern vessels are being introduced.

The book is of convenient size, excellently printed and bound and should fit conveniently on any ship master's book shelf.

There seems to be one assumption made, i.e. that those people likely to use the book would be familiar with the vernacular terminology used by seafarers, but this assumption may not always be valid and hence a glossary of terms, placed conveniently either at the back or in the front of the book might in practice be found useful.

This reviewer would also like to see an index incorporated in the next edition of Mr. Hulse's book since in the present format, it may be sometimes a little difficult to find quickly the particular point upon which clarification might be needed.

Finally, the reviewer would like to commend this book unreservedly to the attention of fisheries authorities and officials of Marine Departments, Harbour Boards and similar organizations as well as to those students of seamanship, particularly in the fishing industry who look forward eventually to operating and owning modern fishing vessels.

Governments of the region might well look into the question of translating into the local language this very useful volume which it would seem would need to be amended only in terms of local port and shipping requirements. "The Local Master Handbook" is obtainable from the Hong Kong University Press, Hong Kong, @ HK$30.00.

Annual Report of the Division of Fisheries and Oceanography, CSIRO, Australia, for 1959-60, 22 pp., mimeo.

The contents are as follows: (1) introduction: buildings; ships; staff; cooperation with other institutions. (2) Oceanograply: operations of research vessels; physics; hydrology (analytical methods, oceanic, boastal, Eden Area); productivity; zooplankton; phyloplankton; biochemistry; bacteriology; benthos. (3) Fisheries: whales; sea fish (barracouta, tuna, demersal fish); trout investigations; crustacea and shellfish (Western crayfish, Southern crayfish, pearl oysters); taxonomy; marine fouling. (4) Publications: there is a list of fortynine papers published bring 1959-60.

MEETINGS AND CONFERENCES

Intergovernmental Conference on Oceanographic Research

Scientists and government officials from 34 countries meeting in Copenhagen from July 11 to 16 at the invitation of Unesco have agreed to place the whole subject of oceanography on an international footing. Recognising the importance of oceanographic research for the world as a whole they recommend that Unesco set up a permanent Intergovernmental Oceanographic Commission (IOC) within UNESCO's Department of the National Sciences to organise concerted action by

states and by international bodies.

Emphasising the great potential of the seas as a source of food, raw material and energy, as the controlling factor of the climate in many parts of the world and as both barrier and route of communication between populated land masses, the Conference cited various examples of problems which heed scientific research. "In order properly to interpret the full value of oceans to mankind they must be studied from many points of view. Pioneering research and new ideas must come from individuals and small groups, but many aspects of oceanic investigations present far too formidable to task to be undertaken by any one nation or even a few nations."

The Conference brought out clearly that the main obstacle to the development of oceanographic research is the lack of truly qualified oceanographers.

This led to the recommendation that the number of fellowships financed by UNESCO be appreciably increased so as to offer greater training facilities for such specialists, particularly for those countries in which oceanography is little developed and which wish to participate in oceanic research. Such training should included participation in expeditions organised by the various countries or by UNESCO and in short lecture courses or training courses in research institutes and institutions of higher education. Unesco is also asked to organise a conference of deans of science faculties or science professors from all over the world to discuss the means of developing teaching in the marine sciences in the university.

Because the training of oceanographers is so urgent, the Conference recommended that the money proposed in UNESCO's budget for 1961-62 for the operation of an international oceanographic vessel be used for other training activities, the vessel to considered further when the IOC meets.

Other steps towards international cooperation recommended by the Conference in a series of resolutions are the standardization and intercalibration of methods and equipment—such as the sizes and types of nets and the techniques used in the collection of plankton; the collection and exchange of oceanographic data; and the organisation of joint research programmes in specified regions by groups of countries, such as the one planned for the Indian Ocean.

The Conference also voted a resolution asking governments and international organizations concerned to take immediate steps to prevent pollution by radio-active materials, and to intensify their research programmes in this field.

GFCM Urges Two Fishery Projects

Two projects requiring special financial support by member countries and calling for studies by FAO were recommended today by the utilization committee of the General Fisheries Council for the Mediterranean (GFCM).

The committee's recommendations, which are subject to approval by the GFCM at its plenary session deal with standardizing fish packing and tuna-fish preservation.

The group, under the chairmanship of Mr. Joseph Asciak, director of Fisheries for Malta, said that it is extremely advisable to standardize fish packing in all of the 12 GFCM member countries. It suggested that FAO undertake a study on the international standardization of fish packing, based on a limited number of boxes with specific dimensions and built for a specific species of fish. The member countries would contribute to the study by making their experts available and by special financial support.

It was also suggested that FAO begin a study of tuna-fish preservation using the GFCM country that offers the best possibilities for the study. The investigation would deal with both the supply of raw material and with manufacturing. The other member countries would supply data to aid the experiments and also contribute special financial support.

In outlining part of the program for the GFCM's seventh sessions, to be held two years hence, the utilization committee drew the attention of the Council members to developing fish-meal production for human consumption. It also suggested standardizing the process of manufacturing semi-preserved fish with special regard to the European Common Market.

The recommendations of the utilization committee, as well as recommendations from the four other GFCM committees, will be used by the GFCM to draw up its program of work for 1960-62. The GFCM will also elect new council officers at its Wednesday meeting.

Delegates present represent Spain, France, Monaco, Italy, Yugoslavia, Greece, Turkey, Tunisia, Morocco, Israel and the United Kingdom (Malta), plus an observer from Libya and observers from nine international organizations.

DEX
(Order of Magnitude)

Prof. J.B.S. Haldane, now with the Indian Statistical Institute, Calcutta, has pointed out that the phrase "Order of Magnitude" has at least two meanings, that in relation to its use in astronomy where it is employed to describe the amount of radiation reaching an observer or instrument on the earth in a given time from one star as compared with the amount of radiation from another star. The other general use of the term is when entities are compared, the one being said to exceed the other by an "Order of Magnitude" if it is 10 times as large. Prof. Haldane writes "There is a shorter and more precise word to express such a comparison. This is the word 'dex', for 'decimal exponent', due to Allen (Allen, C.W., Observatory 71, 157 [1951]; Allen, C.W. "Astrophysical Quantities" [London, 1955]). He defines it as follows. "Dex converts the number before it into its 10-based antilogarithm. The term can be used for a typographically convenient method of expressing large numbers, as in the example $10^{39} = 39$ dex. It can also be used to introduce verbal simplicity into statements on probable errors, ranges and variations." He gives among others, the example "The frequency range of useful radio-astronomy observations is 3.2 dex". "I suggest that outside astronomy 'dex' can always be substituted for 'order of magnitude' with advantage. I give a few examples from biology. "The range of weights of vertebrates is 10 dex, that of weights of birds only 4 dex." "A man consists of about 14 dex of cells." "There are about 11 dex of birds." "The coefficient of variation of linear dimensions of unworn mammalian teeth rarely exceeds 0.05 dex." "The human ear has a frequency range of about 3.5 dex (1 octave = 0.301 dex) but the range of tones used in music is only 2.1 dex."

"It can also be used with advantage in the social sciences, for example, "There are 8.6 dex of human beings in India, and about 8 dex of adult males. The range of incomes certainly exceeds 3 dex and may exceed 4".

"Biologists will have to learn to think rapidly in terms of large numbers, as physicists, chemists, astronomers, and geologists do already; and even in the case of small numbers, the use of the word 'dex' may be an aid to precision of thought. I venture to hope that it may also be taken over from the terminology of astrophysics into other non-biological sciences. I am trying to use it systematically in lectures in this Institute". (From *Nature*, 3 Sept. 1960).

SCHEDULE FOR PROPOSED FAO MEETINGS

Date	Subject of Conference	Convening Body and/or Organizers	Location
	1961		
	MEETINGS		
6-23 Jan.	Indo-Pacific Fisheries Council 9th Session	J.A. Tubb (FAO)	Karachi
15-30 Sept.	"Health from Seas" Meeting	–	Washington
Undet	FAO International Meeting of Fish Processing Technologists	E. Heen (FAO)	Undet
Undet	FAO/ECAFE Meeting on Food Consumption Surveys	–	Bangkok
Undet	Joint FAO/WHO Expert Committee on Nutrition	–	Geneva
	TRAINING CENTERS		
March/April (6 weeks)	Training Center on Fish Processing Technology	–	Quezon City
Sept.	Fishermens Training Center	–	South Pacific Commission Area

IMPORTANT IPFC PUBLICATIONS

PROCEEDINGS (Records of Council Sessions.)

*First Meeting, Singapore, 24 - 31 March 1949

Section I:	Report of Proceedings
Section II:	Working Papers
Section III:	Contributed Papers
Section IV:	Symposium Papers

Second Meeting, Cronulla, N.S.W., Australia, 17 - 22 April 1950

Section I:	Report of Proceedings
Section II:	Technical Papers
Section III:	Symposium Papers

Third Meeting, Madras, India, 1-16 February 1951

Section I:	Report of Proceedings
*Section II:	Technical Papers
*Section III:	Symposium Papers

Fourth Meeting, Quezon, Philippines, 23 October - 7 November 1952

Section I:	Report of Proceedings
*Section II:	Technical Papers and Symposium Papers

Fifth Meeting, Bangkok, Thailand, 22 January - 5 February 1954

Section I:	Report of Proceedings
*Section II:	Technical Papers
Section III:	Symposium Papers

Sixth Session, Tokyo, Japan, 30 September - 14 October 1955

Section I:	Report of Proceedings
Section II:	Technical Papers
Section III:	Symposium Papers

Seventh Session, Bandung, Indonesia, 13 - 27 May 1957

Section I:	Report of Proceedings
Section II:	Technical Papers
Section III:	Symposium Papers

Eight Session, Colombo, Ceylon, 6 - 22 December 1958

Section I:	Report of Proceedings
Section II:	Technical Papers
Section III:	Symposium Papers

(* Items so marked are out of print.)

CURRENT AFFAIRS BULLETIN

No. 1-29 July 1951 - December 1960 (* 1-21, 23)

SPECIAL PUBLICATIONS (Irregular)

*No. 1: Schuster, W.H. (1952). Fish Culture in Brackish-water Ponds of Java. 1 - 143 pp.

*No. 2: Anonymous, (1952). Fish Culture in Indonesia. 1 - 126 pp.

No. 3: Zaneveld, J.S. (1955). Economic Marine Algae of Tropical South and East Asia and their Utilization. 1 - 55 pp.

No. 4: Anonymous (1958). Annotated Bibliography on Fishing Gear and Methods.

MISCELLANEOUS

Directory of Fisheries Institutions—Asia and the Far East.

1960 OCCASIONAL PAPERS (Irregular, Mimeo)

No. 60/1 *Tilapia mossambica* (Peters)—Preliminary findings in Netherlands New Guinea, by G.A. Reeskamp Jr.

No. 60/2 Preliminary List of the Fishes of Rajasthan, by G.R. Chaturvedi.

No. 60/3 "One-Man" Measuring Board, by T. Williams.

No. 60/4 Bibliography of Fish Behavior.

No. 60/5 The Use of Non-Defatted Fish Meal for Rearing Domestic Ducks, by R. Lafont and Dr. M. Huard.

(* Items so marked are out of print.)

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